PROCEEDINGS

OF

THE ROYAL GEOGRAPHICAL SOCIETY.

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14.

SESSION 1876-7.

First Meeting, 13th November, 1876.

SIR RUTHERFORD ALCOCK, K.C.B., PRESIDENT, in the Chair.

PRESENTATIONS.—*O. C. Stone, Esq.*; *Rev. John P. Hobson*, M.A.

ELECTIONS.—*Peter George Laurie, Esq.*; *L. Rosenthal, Esq.*

DONATIONS TO LIBRARY, 26TH JUNE TO 13TH NOVEMBER, 1876.—Memoirs of the Geological Survey of India, Ser. ix., 4, Cephalopoda, by W. Waagen; xi. pt. 2; Records, ix. pt. 1 (*Dr. Oldham, Superint. of Survey*). The Encyclopædia Britannica, 9th ed., vols. i.—iv. (*Messrs. Black*). MSS. Private Journals of W. H. Hooper, Voyages of the Isabella and Alexander, Hecla and Griper, and Hecla and Fury, in search of a North-west Passage, 6 vols., 1818—1825 (*W. E. P. Hooper, Esq.*). Viaggio intorno al Globo della R. Pirocorvetta Italiana Magenta, di E. H. Giglioli; Milano, 1875 (*Author*). Account of primitive tribes and monuments of the Nilagiris, by J. W. Breeks, 1873; Report of a Mission to Yarkund in 1873, under command of Sir T. D. Forsyth, Calcutta, 1875; and a Statistical account of Bengal, by W. W. Hunter (5 vols.), 1875 (*H.M. Secretary of State for India*). The Crimea and Transcaucasia, by J. Buchan Telfer, 1876 (*Author*). Journey in the Caucasus, by Max von Thielmann, translated by C. Heneage, 1875 (*Charles Heneage, Esq.*). Physikalische Beschreibung der Argentinischen Republik, vol. i., Buenos Aires, 1875, por H. Burmeister, and Translation in French by E. Maupas, Paris, 1876; also Caballos fosiles de la Pampa Argentina, Buenos Aires, 1875 (*Dr. H. Burmeister*). Notes of a Journey in Russian Turkistan, &c., by E.

Schuyler, 1876 (*Messrs. Sampson Low & Co.*). The Lucknow Album; Calcutta, 1874 (*E. Bickers, Esq.*). Handbook for South Africa, 2nd. ed., 1876 (*S. W. Silver, Esq.*). Handbook for Spain, 4th ed.; 1869, and Between the Danube and Black Sea, by H. C. Barkley, 1876 (*J. Murray, Esq.*). Virginia, a geographical and political Summary; Richmond, Va., 1876 (*H. N. Courtney, Esq.*). Parliamentary Reports on Arctic Expedition, Telegraphic Weather Intelligence, British Islands, 1875, Colony of Assunguy, Boundary between Canada and the United States, Islands of the Southern Ocean, New Guinea, Malay Peninsula and Straits Settlements, Trade between British Burmah and Western China, Expedition to Nan-Chang-Foo, Treaty between Japan and Corea, the murder of Mr. Margary, Affairs of the Gambia, West African Possessions, and Delagoa Bay (*Lord Arthur Russell, M.P.*). Observations on Ozone, by H. A. Cutting; Vermont, U.S.A., 1874 (*Author*). Subsidies to the formation of the physical Map of Brazil, by Homem de Mello; Rio de Janeiro, 1876 (*Author*). Registrande der geogr.-statistischen Abtheilung des Grossen Generalstabes, vi., for 1875 (*The Prussian General-Staff*). Astronomical and Meteorological observations in 1873, U. S. Naval Observatory; Washington, 1875 (*Lieut. G. M. Wheeler*). Meteorological tables and observations near the Victoria Nyanza, by E. Linant de Bellefonds, 1875 (*General Stone*). Zur Kartographie der europaischen Turkei, and Zur ethnographischen Karte des europaischen Orients, von H. Kiepert; Berlin, 1876 (*Author*). Reports of foreign Societies on awarding medals to American Arctic explorers; Washington, 1876 (*Prof. Nourse*). Notes on Geology of N.E. New Mexico, by O. St. John; Washington, 1876 (*Author*). Livingstone, Poeme par G. Vallat; Moulins, 1876 (*Author*). Appalachia, organ of Mountain Club, Boston, 1876, vol. i., No. 1 (*The Club*). Archivos do Museu Nacional do Rio de Janeiro, vol. i., 1st trimestre, 1876 (*C. F. Hartt, Esq.*). Geographia fisica de Chile, por A. Pissis, text and atlas; Paris, 1875 (*H. E. Don Alberto Blest Gana, Chilian Minister, per T. K. Weir, Esq., Chilian Consul*). K. Svenska Fregatten Eugenies Resa, Haft. 13 & 14 (*The R. Academy of Sciences at Stockholm*). Results of Meteorological Observations, Vizagapatam, by A. V. Nursingrow; Calcutta, 1876 (*Author*). Tables of Temperatures of the Sea, reduced from observations during 1749—1868, by J. Prestwich, 1875 (*Author*). Botanical Reminiscences in British Guiana, by R. Schomburgk; Adelaide, 1876 (*Author*). A self-instructor in Navigation, 1876, and Lunars and Lunar tables, 1875, by W. H. Rosser (*I. Imray, Esq.*). The Cruise of the Freak, by Canon Brownrigg; Launceston, Tasmania, 1876 (*S. S. Crispo, Esq.*, *Admiralty Survey, Melbourne*). On the general causes of Ocean-currents, Upsala, 1876, and Description of Instruments exhibited at Philadelphia, Stockholm, 1876, by F. L. Ekman (*Author*). Genève et le Mont Blanc, par A. Delaire; Paris, 1876 (*Author*). Carrara Marbles, by G. A. Lebour, 1876 (*Author*), Central-Afrika, von J. Chavanne; Wien, 1876 (*Author.*) Journal of a tour through the Panjab, Afghanistan, &c., with Lieut. Burnes, by Munshi Mohan L'al, Calcutta, 1834; and Notice biographique sur J. Balmat, par M. Carrier, Genève, 1854 (*S. M. Drach, Esq.*). Canal interocéanique à travers le territoire du Darien; Paris, 1876 (*General E. Turr*). De l'Industrie agricole de Luxembourg, par E. Reuter; Luxembourg, 1875 (*Author*). Catalogo ragionato delle piu rare opere geografiche del Collegio Romano, da C. Castellani; Roma, 1876 (*Author*). Eine geologische Reise in den westlichen Balkan, von F. Toula; Wien, 1876 (*Author*). The Antananarivo Annual and Madagascar Magazine, No. 1, 1875 (*W. Johnson, Esq.*). Report by the Rev. R. Price of visit to Zanzibar, 1876 (***Rev. J. Mullens***). On changes in the tidal portions of the Mersey, by J. N. Shoolbred, 1876 (*Author*). Photograph of Captain J. Ross (*M. Feuillet de Conche, per M. Chas. Maunoir*). Life on the Nile, by W. W. Warren; Paris, 1867 (*Librarian*). Recherches sur le mouvement de la population de Genève, 1845- 1872, par P. L. Dunant; Genève, 1876 (*Author*). Exploracion mineral en el Estado del Magdalena, Colombia; Cartajena, 1876 (*Archibald Peel, Esq.*). Calendario Azteca, por A. Chavero; Mexico, 1876 (*Author*). Report on the newly opened ports of Kiung Chow and Hai-Phong, by N. B. Dennys; Hong Kong, 1876 (*Author*). On the weather of 13 years at London, by R. Strachan, 1876 (*Author*). On the Mineral Resources of India, by W. T. Blanford, 1873 (*Prof. J. Tennant*). Exploration du Sahara central, Avenir de La France en Afrique, par P. Soleillet; Paris, 1875 (*Author*). Rates of Chronometers on trial, 1876; Arctic Expedition, Report of Proceedings, 1876; and H.M.S. Challenger, Report No. 6, on Soundings, &c., Pacific Ocean, 1875 (*The Lords Commissioners of the Admiralty*). Memorandum descriptive of the route between Sohar and El Bereymee in Oman, by E. C. Ross, 1876 (*H.M. Secretary of State for India*). The Franco-German War, 1st part, Sect. ix.; The armed strength of the German Empire, Part i.; and The armed strength of the Netherlands; by F. C. H. Clarke (*H.M. Secretary of State for War*). Publications of the Dépôt des Cartes et Plans de la Marine, Nos. 537, 546, 548—557 (*The French Admiralty*). Contribution to the Meteorology of Japan, by T. H. Tizard, 1876; Report of the Meteorological Committee of the Royal Society for 1875; and Results of

Monthly Observations, 1869—1875 (*The Meteorological Committee*). South Kensington Museum, Handbook and Catalogue, Special loan collection of Scientific Apparatus, 1876; Reports of Committee of Council on Education, England and Wales, and Scotland, 1875–6, and 3rd Annual Report of Board of Education for Scotland, 1876 (*Committee of Council on Education*). Journal of Mr. Lewis's Lake Eyre Expedition, 1874–5 (*H.M. Secretary of State for the Colonies*). Victoria: Statistical Register for 1875, parts 1, 2, 3, 4: Indexes for 1873, Patents, by R. Gibbs, 1875; Report of Chief Inspector of Mines for 1875; Mineral statistics for 1875; and Reports of Mining surveyors, 30th June, 1876 (*The Victorian Government*). Geological Survey of Victoria, Report of progress by R. Brough Smyth, with Reports on Geology, Mineralogy, and Physical structure by F. M. Krausé, and others; Melbourne, 1876 (*The Victorian Survey*). Statistics of New Zealand for 1875 (*The Registrar General of New Zealand*). Results of Meteorological observations made in N. S. Wales during 1874 (*The New South Wales Government*). Report of U. S. Geological Survey of the Territories, vol. ix. (Invertebrate Fossils of the Upper Missouri, by F. B. Meek), and x. (Phalænidæ of United States, by A. S. Packard); Washington, 1876 (*Dr. F. V. Hayden*). U.S. Geological Exploration of the 40th parallel, vol. v., Botany, by S. Watson and others; Washington, 1871 (*Clarence King, Geologist in charge*). Annual Report on geographical Explorations west of 100th meridian, California, &c., by G. M. Wheeler, and Report upon Geographical and Geological explorations and Surveys, &c., vol. iii., Geology; Washington, 1875 (*Lieut. G. M. Wheeler*). Botany, vol. i., uniform with publications of the Geological Survey of California; Cambridge, U.S.A., 1876 (*J. D. Whitney, State Geologist*). Reports of Superintendent of the U.S. Coast Survey, showing the progress in 1869, 1870, 1871, 1872, and 1873 (*C. P. Patterson, Superint. of the Survey*). Geological Survey of Canada, Report of progress in 1874–75 (*The Director of Survey, on behalf of Government of the Dominion*). Buletinul Societatii Geografice Romane, vol. i., Nos. 1—8; Bucharest, 1876 (*The Society*). Boletin de la Sociedad Geográfica de Madrid, vol. i., No. 1; Madrid, 1876 (*The Society*). Bulletin trimestriel de la Société Khédivale de Géographie du Caire, Nos. 1 and 2; Le Caire, 1876 (*The Society*). Also Transactions of the Royal Society of Edinburgh, xv., pt. 1; Proceedings of the Boston Society of Natural History, various sheets of vols. xi. and xiii., and Memoirs, vol. ii. 7 parts; K. Svenska Vet. Akad. Handlingar, xi., 1872; R. Instituto Lombardo, Memorie, x., fascc. i.—iv.; Bulletin de la Société de Géographie, 1ère série, vols. xix. and xx., and Table des Matières, 1844 à 1861; given by the various Societies, &c., mentioned, in or towards completion of series; the continuation of Reclus's Géographie Universelle, vol. ii., by the Author; and the current issue during the above period of publications of various corresponding Societies, and of Periodicals.

Donations to the Map-room from June 26th to November 13th., 1876.—162 sheets of the Government Surveys of India (*H.M. Secretary of State for India, through the India Office*). 24 sheets of Admiralty Charts (*Hydrographic Office*). 38 sheets of French Charts (*Dépôt de la Marine*). 19 sheets of Ordnance Survey of Great Britain, Parish maps $\frac{1}{2500}$ *H.M. First Commissioner of Works, through Major-General Cameron*). Map of Albert Nyanza, by M. Gessi; Map of the Nile between Dufli and the Albert Nyanza, by M. Gessi; Map of the Nile between Dufli and Magungo, by S. E. Gen. Gordon-Pacha; Map of the Victoria Nile between Shoa Morou and Foweira, by S. E. Gen. Gordon-Pacha; Map of the Victoria Nile between Foweira and Mrooli, by S. E. Gen. Gordon-Pacha; Plan of Town of El Obeyad, by Commandant Prout (*Gen. Stone, Chief of the General Staff, Cairo*). MS. map of Albert Nyanza, by Rom. Gessi: MS. map of the Nile between Dufli and the Albert Nyanza, by Rom. Gessi (*Author*). Part XV. of the Geological Survey of Sweden, 3 sheets (*Otto Torell, Director*). MS. map of the Valleys of the Tibagy and Ivahy, Brazil (*T. P. Bigg-Wither, Esq.*). Map of the Sandjak Filibe (Philippopolis), European Turkey, by H. Kiepert 1876 (*Author*). Map of California and Nevada, 2 sheets; Topographical map of Central California, &c., 4 sheets; Region adjacent to Bay of San Francisco, 2 sheets; Part of the Sierra Nevada adjacent to the Yosemite Valley; Map of Yosemite Valley (*J. D. Whitney, Esq.*). Map to illustrate the History of Peru previous to 1553, by A. Raimondi, 1875 (*Author, through C. R. Markham, Esq.*). Parts VII., VIII., IX., of the Topographical Atlas of Switzerland, $\frac{1}{25000}$ and $\frac{1}{50000}$, 36 sheets (*Col. Siegfried, Director*). Physical map of Brazil, by F. J. M. Homem de Mello, 1875; Illustration of the Comparative Altitudes of the Culminating points of Brazil, with a key plan, by F. J. M. Homem de Mello (*Author*). Map of the Province of Kwei-Chow, in Chinese characters (*W. Mesny, Esq.*). Geological map of Newfoundland, by Alex. Murray (*Author*). Map of Nova Zemlia and North coast of Russia, with MS. track of steam-ship "Ymer," 1876 (*Prof. Nordenskiold*). Geological map of Scotland, by Arch. Geikie (*W. & A. K Johnston*). Flags of All Nations (*Jas. Reynolds, Esq.*). 4 charts of the North Atlantic Ocean, showing the direction and force of the Wind, by L. Brault, French Navy, 1874 (*Author, through J. F. Imray, Esq.*).

As soon as the Chair was taken, Mr. H. M. HYNDMAN rose to move a Resolution of which he had given notice.

The PRESIDENT said Mr. Hyndman was quite out of order.

The formal business of the Meeting was then proceeded with.

The PRESIDENT then stated that he had to bring before the Fellows a question which had been raised by one of their members, who had given notice to the Council some days previously that he would move a Resolution on that evening; the notice had been carefully considered that day by the Council, and a Minute was agreed to, which he would call upon the Secretary to read.

The SECRETARY (Mr. C. R. Markham) read the following Minute:—

Minute of Council, Nov. 13, 1876.

"A letter of the 23rd October from Mr. H. M. Hyndman having been read, giving notice of his intention to move at the Evening Meeting of the 13th November, a Resolution involving a vote of censure by the Council and Fellows of the Society of Mr. H. M. Stanley's method of dealing with the natives of Central Africa,—it was resolved unanimously that the Council considered it contrary to the Rules regulating the order of proceedings at the Ordinary Evening Meetings (chap. v., section 3, par. 4, 5) for any Fellow of the Society to bring forward a Resolution on any matter foreign to the proper business of the Meeting."

Mr. HYNDMAN again rose and asked to be permitted to say a few words with reference to the opening Address of their illustrious President, Sir Henry Rawlinson, on the 15th November, 1875.

The PRESIDENT said that after the Minute of the Council they had just heard read he could not listen to anything which might lead to a discussion on a matter perfectly irrelevant to the proceedings of the Meeting as they had been arranged. Such was the Rule of the Society. The Council, however, would be sorry to be supposed to be desirous of suppressing any expression of opinion on the part of any of the Fellows; and if Mr. Hyndman and six other Fellows (the number required by the Regulations) would sign a requisition to the Council to call a Special Meeting to consider the amendment of the Rule prohibiting these motions, and if the Special Meeting agreed that the Rule was not a good one, though it had been in force for twenty or thirty years, of course some other Rule might be substituted; but as long as the present Rules existed the Chairman must enforce them.

The PRESIDENT, in opening the Session, addressed the Meeting as follows:—

THE duty of opening this, the Forty-seventh Session, of the Royal Geographical Society, which has devolved upon me by my election as your President at the last Anniversary Meeting, cannot fail to be a source of gratification to whoever you may thus honour with your confidence. I could have wished, indeed, that your choice had fallen on one more distinguished in Geographical Science, or by explorations of importance in unknown lands—of which class you number many, both in your Council and among the Fellows of the Society at large. But when I glance over the list of Presidents from Sir Roderick Murchison, who may justly be considered the chief Founder of the Society, down to those who have more recently filled this Chair—Sir Bartle Frere and Sir Henry Rawlinson, more especially, who, though still actively engaged in the public service, have by their energy and personal influence greatly contributed to the prosperity and reputation of the Society—I may be well satisfied if I can emulate to any extent the earnest and generous spirit in which they have laboured as your Presidents, for the increased usefulness of this associated body of Geographers.

We are again indebted to the Senate of the University of London, as in so many previous years, for the permission to hold our meetings in this hall. The liberality of that enlightened body, and their continued kindness in allowing us, year after year, the use of this commodious theatre, is I am sure fully appreciated by the Fellows of the Geographical Society. It is not in our power to make any return beyond this public acknowledgment of the great service rendered, not to this Society only, I venture to think, but to the cause of Geographical Science and Discovery, and also to the public, by making the knowledge acquired more accessible.

Our steadily increasing numbers, with corresponding increase of income, may be taken as sufficient evidence of popular interest in our work, as well as the repute in which the Society is held, and both form a legitimate subject of congratulation on the opening of another Session. But these advantages, as my predecessor (Sir Henry Rawlinson) intimated in his closing address, are not without their drawbacks. In the ordinary business of these meetings, this handsome and commodious hall affords ample accommodation, and is, indeed, all we could desire. It is otherwise, however, when the objects of the meeting are of exceptional interest, and present some extraordinary attraction. On such occasions the number of those who are entitled to be present, exceeds the capacity of this, or any hall where the voice of the speakers can be distinctly audible, and the diagrams and maps visible from the more distant parts. The number of Fellows at the present time is 3199; and each Session, for several years, has brought an increase of from one to two hundred. Such numbers, without counting visitors, cannot be accommodated here, where, I believe, there are only seats for 1000. It is true all the Fellows are not in London, or in England probably, at any one time, and many do not attend, as a rule. But, on the other hand, as each Fellow, by the Rules of the Society, has the privilege of introducing a visitor, it will be seen that the number of seats required on such occasions, as are here referred to, must be far in excess of any accommodation that can be provided. On the last event of this kind, when Lieutenant Cameron returned from his memorable "Walk across Central Africa," the Council engaged St. James's Hall for the meeting, in anticipation of the public interest that would be manifested, and the eager welcome that awaited him. That hall will, I believe, seat 1700 comfortably, and rather more on a press; but, notwithstanding this increased accommodation, many Fellows and their friends, it appeared, were unable to gain an entrance, and much disappointment unavoidably followed. Within what range, limited as this must be by the physical conditions of space, in connection with useful sight and hearing, a single Society can provide the requisite facilities for the accommodation and Geographical instruction of the public in this great Metropolis has not yet, perhaps, been very definitely determined. But it is obvious there are no means at the command of the Geographical Society, as at present constituted, to make provision for the accommodation of many thousand persons on any one occasion. In other respects, so long as we can be assured that there is no diminution of reputation, influence, or usefulness, it is difficult to regard this affluence of numbers as a subject of regret. Neither reputation nor usefulness depends altogether upon the meetings, or the attendance upon them. Many Fellows who seldom appear here, enjoy the advantage of our printed 'Journal' and 'Proceedings,' and the information they convey, together with access to the Map-Room and Library, daily enriched by new contributions and valuable acquisitions. Any attempt therefore to check the increase of numbers by fixing a maximum—or the attendance at these meetings by excluding the visitors, would, I believe, be alike open to objection. Societies, like nations, when they cease to increase, generally begin to decline; while continuous growth is an evidence of vitality and healthy vigour. We would not voluntarily exchange our present prospering condition for one of decreasing numbers, and possible stagnation, for want of the constant inflow of new blood, bringing fresh elements of strength and active life. As little, I may venture to predict, should we like to be without the inspiriting presence of our visitors. They represent at these meetings the public, whose interest in our work is very encouraging and valuable. Its interest in that work, and approval of our efforts for the advancement of Geography in all its branches, are our main support, and lie at the root of much of our influence. Whatever may be said of Societies being "popular," to the disparagement of their claims to be considered "scientific," I should be very sorry to see the Geographical Society shorn of its popular element. What it might gain in dignity, I feel sure, it would lose in usefulness, inasmuch as its means of affording instruction in a popular form would be seriously impaired. The ladies, who often grace our meetings with their presence, might lose something if the Geographical knowledge which is provided here, probably, in the form most acceptable to them, were no longer accessible; and I am quite certain the Society, and these meetings, would lose very much by their absence or exclusion. I allude to these matters now merely to point out the necessity of contenting ourselves with the great advantages we enjoy, without vainly disturbing ourselves, because there are some unavoidable drawbacks attending them.

I have been occupying you with some account of our prosperous condition—our rapidly increasing numbers and income; but the true measure of value does not consist in these—not even in popularity perhaps, however long enjoyed or fairly earned. Unless we can show that such influence as these conditions bring is being directed to wise and adequate ends, and conduces to the attainment of objects of public utility which might otherwise be missed, it would be a poor boast that we had great means at our disposal. I am glad to think, therefore, that, tried by this test, we shall not be found wanting. We may not only point with satisfaction to the valuable records of Geographical research and useful work to be found in the printed transactions of the Society, and the forty-five volumes of the 'Journal,' with their accompanying maps; but to great national undertakings for Geographical and scientific objects, such as the Livingstone East Coast Expedition and the Arctic Expedition. In both, the Society took an active part in promoting their inception and otherwise furthering their success. It was the advocacy of the Royal Geographical Society of London, reinforced by that of the Royal Society, which not only tended to keep alive public interest in the objects of the Arctic Expedition, but mainly determined, I believe, her Majesty's Government to entertain proposals for its despatch. As regards the Livingstone Search and Relief Expedition, this Society very naturally took a leading part. Aided by public subscriptions and the assistance of the Government, we accepted the whole responsibility, and continued to the end, when all other resources failed, to supply the funds that were needed to bring its adventurous Commander back in safety. These are services which, I think, the Geographical Society may without vainglory or presumption, be permitted to regard with satisfaction as worthy and useful ends to have accomplished with the means at their disposal. The results obtained by these undertakings cannot yet be fully determined. Before we can estimate their value in a Geographical or scientific sense, we must have before us the detailed accounts which, in due time, are certain to be furnished by the heads of the Expeditions, and we must wait patiently for them, knowing that, where such numerous scientific data have to be tested, classified, and their final outcome rendered in clear and intelligible form for public information, time and labour are both required. But of the Arctic Expedition we know sufficient already, independent of the more scientific results, to feel assured it brings with its return a conviction that a further advance to the North Pole by Smith's Sound is impracticable. Assuming this to be ascertained, I do not conceive, however, that it can with justice be considered a merely negative result. To me it seems a very positive and useful result to have achieved; for the next best thing to reaching the North Pole, is to demonstrate the impracticability of such an achievement, and so close the chapter of failures which have been attended with much loss of life, and years of serious suspense and anxiety. The mystery of "an open Polar Sea" has been dispelled, by what appears to be conclusive evidence that it has no existence. There has also been a gain to positive knowledge in demonstrating, for the first time, the true nature of the climate in the Polar area. We may rejoice that the British Flag has been carried nearer the North Pole than any other, in the van of all at 83° 20′ 26″, and has been planted in the most desolate region yet discovered on the globe—only 400 miles from the Pole. Not indeed for the puerile vanity of being a few miles nearer the "earth's summit," but because to be the first in such a struggle, proves the possession of some of the best and highest qualities of our race—dauntless courage, physical powers of endurance of a rare order, sustained by unfailing energy and an unconquerable will. It is only men of such a type, the best and highest we know, who can win their laurels in endeavours to reach the Pole. It may be, as suggested the other day, that the "North Pole is no more interesting, *per se*, than any other part of the Arctic regions, and is merely that spot on the earth where the sun's altitude is equal to its declination"—but this which may serve as a scientific formula, gives no hold or place for the spirit of the Discoverers in all ages, to whom the unknown, presents an irresistible attraction,—nor the still larger class from which heroes spring, who need no other lure than the certainty of meeting danger and difficulty in their path, and the glory that attends success in triumphing over them. It is from the ranks of these chosen pioneers of our race in the regions of the unknown that

Arctic Expeditions are recruited, and by them alone the noblest triumphs for science and civilisation are won in the fields of discovery. To them a waste of snow and a wilderness of rock, surrounded by ice barriers have no terrors. The limits of all navigation, beyond the furthest range of migration for birds or life for animals, where neither land nor water is, but only a frozen sea, with a night of five months, and a winter's cold ranging 60° below zero, only served to beckon them on to see what yet may lie beyond, in that great book of nature, ice-bound and "sealed throughout the ages" to all the human race, with frozen bands which take degrees of latitude in their span, and crush great ships between their folds, or fast lock them with a frozen grasp to the end of time.

I will not go further into the history of the Expedition and its dangers or difficulties, because I am enabled to announce that arrangements have been made by the Council of the Geographical Society for an Evening Meeting at St. James's Hall on the 12th of next month, when we may hope to have the pleasure not only of giving to Captain Nares and his companions the public welcome they have so richly earned, but of hearing, from his own lips, some of his experiences in the navigation of the Polar Seas. I trust we may also be favoured with an account by Captain Markham of his memorable sledge expedition, and from Captain Feilden, of the distribution of life in those frozen regions.

Turning now from the Polar Regions to the Torrid Zone, and the journey of Commander Cameron across the Continent of Africa south of the Equator from the Indian Ocean to the Atlantic. Although the scientific details are not yet before us, some general conclusions may safely be drawn as to the scope and value of the knowledge acquired. His journey, extending over a period of nearly three years, and in a large area west and south of Lake Tanganyika, over entirely untrodden ground, has enabled him to bring home a record of observations of great practical value. The final solution of the great problems connected with the lake and river systems of Central Africa, to the elucidation of which Livingstone devoted so many years of his life, has not yet been accomplished, but his contributions towards that end are of the highest interest. He has returned, too, satisfied of the practicability of opening up to trade all the South Equatorial region, and establishing trade routes across the continent from the Indian Ocean to the Atlantic. Perhaps no greater service could have been rendered as regards the civilisation of Africa and its future intercourse with the rest of the world. If legitimate trade by practicable routes, on land or water, can be established, the way will speedily be paved by peaceable means and civilising agencies, we may hope, for the suppression of the slave-trade and its accompanying horrors.

It was a fitting conclusion to the Livingstone Search and Aid Expeditions to have thus carried out, in the efforts made to reach him with effective aid, the great object of his self-sacrificing labours, and the one which he had most at heart. The purpose to which he devoted his life, in the spirit of a martyr, was the opening of Africa to civilisation and the Gospel. His work, published in 1865, was written, as he tells his readers, "In the earnest hope that it may contribute to the information which will yet cause the great and fertile Continent of Africa to be no longer kept wantonly sealed, but made available as the scene of European enterprise, and will enable its people to take a place among the nations of the earth, thus securing the happiness and prosperity of tribes now sunk in barbarism or debased by slavery: and above all, I cherish the hope that it may lead to the introduction of the blessings of the Gospel." Such was the truly Christian spirit in which this noble-hearted pioneer across the Continent of Africa engaged in his work of Geographical Exploration. And recalling some things which took place previous to the Zambesi Expedition, of which the work in question gives the narrative, he adds, "Most geographers are aware that, before the discovery of Lake Ngami and the well-watered country in which the Makololo dwell, the idea prevailed that a large part of the interior of Africa consisted of sandy deserts, into which rivers ran and were lost. During my journey in 1852–6 from sea to sea, across the south intertropical part of the continent, it was found to be a well-watered country with large tracts of fine fertile soil covered with forests and beautiful grassy valleys, occupied by a considerable population; the peculiar form of the continent was then ascertained to be an elevated plateau, somewhat depressed in the centre, and with fissures in the sides, by which the rivers escaped to the sea." This great physical fact, opened a new world, and coupled with the further knowledge supplied by Livingstone's explorations, that "The fabulous torrid zone," still to quote his own words, "of parched and burning sand, was now proved to be a well-watered region, resembling North America in its fresh-water lakes, and India in its hot, humid lowlands, jungles, ghauts, and cool highland plains," revealed a possible future until then undreamed of either by Geographer or philanthropist, and a vast field for the best influences of Christianity and civilisation, in combination with the development of a large legitimate commerce. Nor had Livingstone been less observant or less capable of appreciating these great elements of a future so rich in promise, could he have failed to note how much encouragement the history of the few years preceding his arrival on the West Coast afforded. He had forced his way there through every kind of peril, and difficulties innumerable, in order, as he said, "to find a path to the sea by which lawful commerce might be introduced to aid missionary operations." His reward was to find, as the result of our long and costly efforts for the suppression of the slave trade by our cruisers and treaties, that the slave trade was so far suppressed as to be spoken of by Portuguese who had themselves been slave-traders, as a thing of the past. He tells us he found "lawful commerce had increased from an annual total of 20,000*l.* in ivory and gold-dust to between 2,000,000*l.* and 3,000,000*l.*, of which 1,000,000*l.* was in palm-oil to our own country. Life and property were rendered secure on the coast, and comparative peace imparted to millions of people in the interior;" while "twenty missions had been established with schools, in which more than 12,000 pupils were taught." Efforts so speedily followed by such results might well receive support from statesmen of all parties, and commend themselves to the people of England for sympathy and aid: and the long-sustained interest of the nation in Livingstone's work, and the hearty and generous response made to every appeal for assistance, so long as there was hope that he still lived on the scene of his labours, was the reward of his arduous labours in this field of Geographical exploration. Cameron followed in the steps of Livingstone, and bravely took up the work which he had been unable to finish, but only relinquished with his life, to return with the full confirmation of Livingstone's most cherished hope that settlements might be made in healthy regions, and a legitimate trade take the place of the existing slave traffic,—with practicable roads into the heart of Africa, from the coast, both east and west; and uniting the great lakes with the Nile and the Mediterranean. Links are still missing for subsequent explorers to supply, but the great outline of such an undertaking is sufficiently complete now for immediate action to be taken upon a large scale. Indeed the work is proceeding at this hour with a rapidity and success which might well have seemed impossible ten years ago. Mr. Stanley is steadily working his way to the West Coast, after having circumnavigated the Victoria Nyanza, and added largely to our knowledge of that great inland sea. It has been reserved for him to prove that it is, not a series of lakes or lagunes, as had been surmised, and the valuable observations made during his progress of the lake and its adjacent coasts and affluents, has enabled Geographers to fill up great blanks in the map of those regions. The Church Missionary Society and the London Missionary Society are both engaged in founding mission stations in Central Africa. Their pioneer parties have been, and are now engaged in examining the routes into the interior from the coast near Zanzibar. According to the latest news, the Church Missionary Party, who aim at establishing a mission at Karagwé, have been exploring the two rivers, the Wami and the Kingani, with a view to ascertaining how far they may help by their navigability in facilitating access to the interior. The results have been discouraging; both rivers being found worthless, or nearly so, for the purpose required; but it is so much knowledge and valuable experience gained, and the preliminary explorations of the London Missionary Society have been very satisfactory. Their agent, Mr. Roger Price, has succeeded in proving, by personal survey and actual trial, the practicability of a bullock-waggon route from the coast as far as Ugogo, free from the plague of the Tsetze-fly. The point which this Society has chosen as a station for its operations is Ujiji on Lake Tanganyika.

The Established and the United Presbyterian branches of the Scottish Church are severally engaged in similar work.* The

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* The following letter from Mr. James Stevenson, of Glasgow, describing more accurately the relation of the Scottish Churches to this Mission, was received after my Address was in print:—

"Glasgow, 15th November, 1876.

"Sir RUTHERFORD ALCOCK, K.C.B., President of the Royal Geographical Society. Sir,—In yesterday's 'Times' I read in your able and comprehensive Address that 'the Established and United Presbyterian branches of the Scottish Church have established a Memorial Station, Livingstonia, on the Lake Nyassa, and launched a steamer upon its waters.' As this will occasion much comment here, although it may appear of little importance in England, allow me one or two remarks in correction.

"The recent initiation of Missions in the interior was the work of the Scottish Free Church, which, fourteen years ago, when the Universities Mission was at Magomero, surveyed the ground, last year founded the settlement of Livingstonia, entirely paid for and, under the supervision of Mr. Young, R.N., who is still in her service, launched the steamer on the Lake, and maintains it there.

"What has created misconception is the circumstance that the Free Church allowed a member of the Established Church to go with their party eighteen months ago to look for a site for an Established Church Mission, quite apart from Livingstonia, and the liberality of the United Presbyterian Church, which sent and paid the salary of an able medical Missionary till the education of the ordained medical man designated by the Free Church should be completed.

"I may properly add, that all the Scottish Missions in Southern Africa, with the single exception of a Mission of the United Presbyterian Church, whose principal work is in Western Africa, and the Scotch Episcopal Mission in Pondo Land, belong to the Free Church; as it was the possession of these bases of operation that was one ground for the advance northwards.

Scottish Free Church last year founded a memorial station, Livingstonia, on the Lake Nyassa, and launched a steamer upon its waters, under the auspices of that admirable pioneer Mr. E. D. Young, with whose name and deeds we are all familiar. And all this—perhaps the most gratifying feature of the whole—is being done with the entire concurrence of the Native Chief of the district. This last mission is established at the mouth of a fertile valley, with anchorage for small vessels on the lake in front of an island opposite.

On the north, from the side of the Nile, Colonel Gordon continues his operations in the direction of the equatorial lakes, and under his judicious direction several of his subordinates, in the course of their other duties, have made explorations of great importance. Thus, early in the present year, he entrusted to a member of his staff, M. Gessi, the task of tracing the Nile up to its outlet from Albert Nyanza and circumnavigating the lake. A brief account of the successful achievement of this task reached us before the end of our last Session; but since then I have been favoured with a detailed report of the journey by M. Gessi himself, a translation of which I directed, during the vacation, to be inserted in the public journals. From this, it will be seen that M. Gessi believed he had defined the southern boundary of the lake, although unable to reach the extreme end, owing to the aquatic vegetation and the shallowness of the water. The recent letters of Mr. Stanley, however, who reached the shores of the same lake some weeks later, seem to show that it extends much further to the south than indicated by M. Gessi. At least the description of the Beatrice Gulf, a feature not seen by Gessi, and the direction of Stanley's route, point to this conclusion. Whilst Gessi was engaged on this important exploration, M. Piaggia had been re-examining the new lake, first seen by Colonel Long, in the course of the Nile between Foweira and Victoria Nyanza, and had brought back to Colonel Gordon's head-quarters information fully confirming Colonel Long's account, the basin being 50 miles in length, and having, further, the interesting

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"For the purpose of setting the matter accurately before the public that a just view may be taken, may I suggest that a communication to the 'Times' might be sent, if no equally prompt means is available.

"I may remark that, in order to carry out the task which Sir Bartle Frere prevailed on the merchants of Glasgow to undertake in connection with the Brussels Congress, it seems to be almost essential to have the assistance of the Free Church steamer, and also of some of the educated natives from her institutions. We can certainly ask it with a better grace if we do not ignore the services she has already rendered in the exploration of the Lake by means of those in her employ, not to speak of her being the first, in fact up to this time, the only body located in the interior north of the Zambesi. I am, &c. James Stevenson."

feature of a second outlet, on the north, in the direction of the Sobat River. According to the latest accounts, Colonel Gordon was preparing to transport his little steamer in sections to Ripon Falls, there to be launched on Victoria Nyanza.

One of the most important results perhaps of the Livingstone Aid Expedition—in succession to his own philanthropic and geographic labours—has been a step taken by the King of the Belgians during the recess. It had become evident, after the experience gained by Cameron, that the cost of prosecuting further explorations, to the extent necessary for the attainment of such desired ends, was far beyond the reach of private enterprise, or any means at the command of Geographical Societies. Some 11,000*l.* has been expended on the Cameron Expedition, and if Central Africa is to be opened to commerce and civilisation in this generation, it can only be by a collective and united effort, and many simultaneous expeditions of nearly equal difficulty and cost. If no views of conquest or annexation be entertained, all the civilised world may cordially join in overcoming the difficulties and supplying the funds needed for so large an undertaking. But a definite purpose, great command of means, and responsible direction towards a common end, must in a great degree take the place of such isolated efforts as have heretofore been the rule. It was with these large and disinterested views that a congress or conference of travellers, geographers, and statesmen from different countries assembled at the Palace in Brussels, at his Majesty's invitation, in September last. With the advantage of all the scientific knowledge and practical experience of many African travellers and Geographers, including the Presidents of the principal Geographical Societies of Europe, the Congress was occupied during several successive days in discussing the best means of opening Central Africa. I will not detain you by details as to the plan of operations contemplated, or the organisation provided for giving permanence to the movement thus initiated, as the procès-verbal of the proceedings is on the table, and may be consulted at leisure, by all who are interested, at the rooms of the Society. I may state, however, for general information that the Congress before its close adopted resolutions for the constitution, in a permanent form, of an "International Commission of Exploration and Civilisation of Central Africa;" and of "National Committees," to be formed in each country. These would be in correspondence with the International Commission as a common centre for the general direction, under an "Executive Committee," presided over by the President of the Commission, of combined operations and exploratory expeditions, and for the employment of any funds transmitted by the National Committees. The King himself graciously acceded to the wish of the Congress that he should be the first President of the International Commission and its Executive Committee, and it only remains now that the National Committees should be effectively constituted to promote the objects contemplated.

It was announced by his Majesty that Madame Heine has contributed 20,000 francs, and no doubt is entertained that a large and generous support will be readily obtained, not in one country only, but among all nations of European race. And since that date information has been received here that the National Committee for Belgium has been definitively constituted, with H.R.H. the Count of Flanders at its head, and more than sixty influential names have been obtained. I also learn that several Sovereigns and Princes have expressed their sympathy, and consented to be enrolled as honorary members of the "International Commission." I am glad to be enabled to state that H.R.H. the Prince of Wales has consented to be the Patron and President of the National Committee for the exploration and civilisation of Africa, now forming in this country. I may further mention that an influential meeting was held on the 10th inst. at Glasgow, in the Hall of the Chamber of Commerce, under the presidency of Sir James Watson, and resolutions were passed constituting a committee to form a Scottish Branch of the British National Society, for the purpose of raising funds, and memorialising Her Majesty's Government to aid in the surveys required to ascertain the practicability of making a road from the northern end of Lake Nyassa to the south end of Lake Tanganyika, and also from the north end of that lake to the seacoast at a point north of Cape Delgado. If a scheme of international co-operation were carried out, as much, I believe, might be done in five years as could otherwise be accomplished in fifty. I do not see that it is at all beyond the bounds of practicability for Africa to be spanned across from East to West by a line of communication, and the Mediterranean similarly connected to Lake Nyassa in the South by the Nile and roads branching off to all the lakes. Within a short period we might have a line of telegraph from Khartoum, on the Nile, to the Diamond Fields in the Cape, to which points it is now extended, and so be opened from one end of Africa to the other. These things are perfectly possible, with public sympathy, co-operation, and support.

Sir Bartle Frere, whose labours in the cause of humanity and for the repression of the African slave trade, are so well known and highly appreciated, was my colleague, together with Sir Henry

Rawlinson, at the Congress: and Sir Bartle has lately given so clear and succinct a statement of the field for philanthropic work now offered by Africa south of the Equator, in an address read at Plymouth, at the Church Congress held there, and of the means by which the King of the Belgians hopes to effect great and rapid results in the interest of humanity and civilisation, that I must beg permission to quote his own words:—"Central Africa," he observes, "had for ages been almost closed or lost to the rest of the world, except as a nursery or hunting-ground for slaves. Admirably adapted by nature for producing and exporting almost every kind of tropical or sub-tropical raw produce, and for consuming in large quantities the products and manufactures of the rest of the world, Central Africa had for three centuries exported little except slaves, every one of whom had been proved in the clearest manner to be procured at the cost of many other human lives, while the process of hunting for them kept the whole country in a state of perpetual insecurity and barbarism. The annual loss of life has been repeatedly proved to be some hundred times greater than the slaughter in Bulgaria, which has so recently shocked the whole civilised world. No one who had any instinct of humanity could refuse to aid in putting a stop to such a horrible waste of human life, and of the good gifts of the Almighty; but how was this to be effected? Governments and diplomatists had done, and were doing, their part, but they could achieve little without the aid of explorers and enterprising travellers to penetrate regions where mistrust of every man's neighbour had hitherto barred the road to all but the armed bands of slave-hunting men-stealers. Naturalists and men of science must follow the explorers to ascertain and report the natural riches of the country; missionaries must follow to teach and civilise, and men of commerce to trade and assist the development of lawful industry. At present those interested in behalf of Central Africa for opening roads and forming stations which should be centres of security and civilisation, were working separately and losing time, energy, and money. The idea of the King of the Belgians is by means of an International Association to unite all these efforts as far as they had common objects in view; to make known to all interested in the work the scattered items of information which now escaped notice in separate transactions and reports; to concert united action where united action was necessary or practicable; and to aid in laying before the Governments and communities of the civilised world such requisites of their great task as could only be supplied by national or diplomatic effort. One of the first wants is, of course, to open roads, and to establish stations which might serve as points of refuge for the weak and needy, as bases of further operations for the explorer and men of science; as resting-places for the traveller and missionary; and as centres of commerce. All experience shows that the establishment of such stations is not only practicable, but that it is the only way in which the objects I have enumerated can be effectually promoted."

I am unwilling to leave the subject of the Brussels Congress which deserves to be memorable from the importance of the questions discussed, and the high purpose directing its deliberations, without some reference to the part taken by its Royal President. At a recent meeting of the Geographical Society of Berlin, Baron von Richthofen, its distinguished President, referring to the initiative of the King, and the manner in which the delegates to the Congress were received, said that, "In no country and on no occasion has so grand and Royal a hospitality been exercised." Science and philanthropy could not have been united under higher or better auspices. Distinguished among the crowned heads of Europe for his devotion to objects of general utility and international scope for the benefit of mankind at large, his action in so great a scheme as the opening of Africa and the suppression of a slave-trade which devastates the whole Continent, and fills it with suffering and bloodshed, was singularly appropriate. And, indeed, Royal sanction and high influence was needed to embolden any one to join in so vast an undertaking. Some of the powers of Sovereignty also may be needed, to give validity by consular authority to various acts in treating with the native tribes and their chiefs. With reference to the gracious reception and hospitality extended to every member of the Congress, I can only say that coming from the King of the Belgians it was a graceful recognition of the claims of science, and more especially, perhaps, of the Geographical Societies so largely represented on that occasion, and so directly concerned in showing the way into the heart of Africa.

It seems only necessary further to mention that, as the objects contemplated by the Congress were not even mainly Geographical, and this Society has always carefully avoided overstepping the proper limits of Geography in any action it has taken, due care was observed by myself and colleagues that it should in no sense be committed. But inasmuch as the chief instrument of success must be Geographical Explorations, and nothing will more effectually promote their successful prosecution in the interest of science than the opening of the interior of Africa to commerce and the influences of civilisation, it is naturally to be expected that all the Geographical Societies will feel anxious to give their cordial support to all such operations as properly come within their sphere, reserving at the same time perfect freedom of action and independence.

During the recess the British Association for the Advancement of Science also held its usual Annual Meeting, the Geographical Section being presided over by our eminent colleague, Captain Evans, who delivered, at the opening of the sectional business, an address dealing chiefly with the Physical Geography of the ocean. Original and suggestive in the highest degree, it especially deserves the attentive consideration of all who are interested in the scientific branches of Geography, on which I shall presently have to speak more at length. Many papers of great merit were read, the authors of some of which I hope may appear before our Society during the present Session. I would particularise those referring to the voyage of the *Challenger* by Commander Tizard, Mr. Murray, and Mr. Buchanan, three members of the Expedition, who gave summaries of the results of the observations made, each in his own department, during their memorable voyage. Thus Commander Tizard reviewed the temperature of the Atlantic, Mr. Murray the Geographical distribution of the deep-sea deposits, and Mr. Buchanan the specific gravity of the surface water of the ocean. Of Papers on Descriptive Geography, there were five relating to Africa; the one attracting most attention being that of Commander Cameron "On the Watersheds and River Navigation of Central Africa." The others being one, by Colonel Playfair on his recent Travels in Tunis in the footsteps of Bruce—a paper of great interest to Historical Geographers; one by Mr. Bowden on a new route (through Liberia *viâ* Musardu) to the Sources of the Niger; and others by Lieutenant Chippindall on the White Nile above Gondokoro, and by Captain Hay on the District of Akem in West Africa. Two important Papers were also read on New Guinea, both by gentlemen recently returned from personal exploration in that great island, namely, one by Mr. Octavius Stone on the Interior District near Port Moresby, and one by Signor Cerutti on the North Western Coast.

The "Oriental Congress" assembled in St. Petersburg this autumn, and some Geographical papers of great interest were read. I am informed by Captain Clarke, who, attended as a delegate from this Society, that they were most cordially welcomed by the Russians, and that the Provisional Committee paid a compliment to the Royal Geographical Society in appointing all the Fellows present to some office—Captain Clarke and Mr. Eastwick being elected Vice-Presidents of one of the Sections, Mr. Robert Cust a Vice-President of the Caucasus Section, and Mr. Delmar Morgan one of the Foreign Secretaries, for which post he was eminently qualified by his knowledge of the Russian language. Although some of the communications bearing on Geography were, as I have said, very interesting—with regard to Central Asia, of which country it might have been expected something new would be learned, little was added to our previous knowledge. Captain Clarke was, by the kindness of the authors, in one or two cases lent the original papers; but as these are in Russian, and it will take some little time for him to translate them, I have not yet received the report of their contents.

I also learn that Colonel Sosnofsky, the chief of the Expedition which started from China in 1874–5 to explore a new trade route between Nanking and the Zaisan Fort (by way of Hankow, Han-jun-foo, Gan-chan-foo, Hanjow-foo, Hami, Barkiul-gu-chen, and Chuguchan), an expedition the importance of which in its bearing on the future relations of Russia and China, and the course of trade across Central Asia, is but little understood in England, has asked Captain Clarke to convey, as a present to the Royal Geographical Society, an Album containing a series of Photographs taken during the Expedition, by M. Bosiarsky, who was attached to the Mission.

Russian explorers appear to be as actively engaged at the present moment on the confines of China and Mongolia, as they have long been in Central and Western Asia. We have had quite recently, thanks to Mr. Delmar Morgan, an English version of the narrative of the Travels of Lieutenant Colonel Prejevalsky in Mongolia, the Tangut country, and the solitudes of Northern Tibet, a work replete with information and interest. England and Russia are both interested in all that improves our knowledge of the inhospitable regions between the southern borders of Siberia and Eastern Turkestan, including great part of Mongolia, Tartary, and Tibet. The caravan routes and centres of trade lie across this vast space separating Peking from Yarkand, to which latter mart all roads converge for the supply of Central and Western Asia. The upper course of the Blue River (the Yangtze) which was reached by the Russian explorers, lies in Northern Tibet. We must see, with Colonel Prejevalsky, that Geographical Exploration in this terra incognita of Eastern High Asia—extending from the mountains of Siberia in the north to the Himalayas in the south, and from the Pamir to China proper, from west to east, and situated in the centre of the greatest of all the continents,—presents, from a scientific point of view, grand and varied fields of research.

Colonel Sosnofsky read no paper himself, and the first part of his Report to his Government, now printed, is not very instructive or satisfactory; but, to judge by the following account in the 'Turkestan Gazette,' the Expedition was one of the greatest interest and importance. We are told that "The Expedition of Colonel Sosnofsky to Western China for the purpose of exploring a new route has been successful. A road has been found nearly 1400 miles shorter than that by Kiachta. This road, from Lan-chu (on the Yellow River) to Zaisan, is perfectly fit for wheeled vehicles; it passes through a populous, fertile and well-watered plain, and only for three days does it traverse a sterile district. From Zaisan it passes through Semipolatinsk and Omsk." Nothing could better illustrate the value and importance of such Scientific and Geographical Explorations than this discovery of a nearly direct line of road, through a populous and fertile district from the centre of China to the great marts and railroad network of Russia, instead of a wide circuit through arid steppes and the shifting sands of the desert, which for so many centuries has been the line trade has taken between Russia and China *viâ* Kiachta. Mr. Price's discovery in Africa of a practicable waggon-road from the East Coast, free from the Tsetse-fly, to the high land and the lake regions, is another example of the important part which Geography plays in the affairs of nations.

The great object of the Russians on the western or Tibetan side is to establish a trade from Semipolatinsk, on the line to Orenberg and Novogorod, to the central provinces of China through Mongolia—and to the far east on the banks of the Amoor, Russia is probably seeking—what may be considered a Geographical necessity in Eastern as in Western Asia—a good seaport, open at all seasons. With such great national objects in view, of primary importance both in a commercial and political point of view, it is easy to understand the intense activity with which these geographical explorations are pushed, and no country is better served, as a rule, by a staff of scientific and hardy officers. Undeterred by vast distances, or pathless deserts and hostile Nomads, they carry on their work; and we, as Geographers, are ready to do honour to their energy and useful labours in such inhospitable regions.

It only remains now that I should very briefly speak on a subject of considerable interest and importance, which has occupied the Council since Sir Henry Rawlinson gave you in his closing Address his very able and exhaustive summary of Geographical progress during the last Session. I mentioned at the last Meeting that it was in contemplation to extend in a more strictly scientific direction the range of the Geographical work the Society had hitherto prosecuted, and to allocate for this end a sum not exceeding 500*l.* annually out of its income, for the promotion of special scientific Geographical investigations in any part of the world, as distinct from mere exploration. One of three directions in which the Committee appointed to consider the subject recommended our efforts to take was the delivery, by persons of recognised high attainments, not less than three lectures at the ordinary Evening Meetings each Session on Physical Geography in all its branches, as well as on other truly scientific aspects of Geography in relation to its past history, or the influences of Geographical conditions on the earth's surface and on the human race. Captain Evans well remarked in his opening Address at Glasgow, speaking more especially of navigators and maritime discoveries, that, "With our present knowledge of the sea-board regions of the globe, little remains except in Polar areas for the navigator to do in the field of discovery," and the same remark might be made of Geographical discovery on land. It is to the development of the scientific features of Geography that the attention of travellers and explorers, whether on land or water, require now to be mainly directed, and in this there is an illimitable field. The progress of science and exact knowledge in every direction creates new exigencies. Distinction to the future explorer can only be secured therefore by a certain scientific training. It can no longer be won by mere descriptive power, or the report of physical features and topographical details. These must now be accompanied by instrumental observations of an order sufficiently high to place numerically before Geographers all the characteristics of the explored region. The days have long passed when Marco Polo and his successors could satisfy all demands by giving the history of their journeys and incidents of travel—supplying only approximate distances and relative situation of the places they mention, calculated by the number of days' journey between each—a measurement of the most dubious kind, as subsequent observations of a more scientific character have shown. No doubt such scientific appliances to supplement the traveller's work of mere exploration or discovery imply the cultivation of branches of science not "strictly pertaining to Geography" as this is commonly understood. But this intrusion into other domains of science is unavoidable. They must of necessity be imported into and made tributary to Geography, in order to give to this its proper uses and full development. Neither *Astronomy, Mathematics, or Geology, nor Natural History or Botany, enter into any popular conception of Geography*—or form any part of the qualifications held necessary for its successful study and advancement. But this forcible intrusion, and a certain overlapping of boundaries, must take place more and more as knowledge advances, by the essential interdependence of each science as parts of a whole, only apparently separable by arbitrary lines of limitation. We need not fear, however, that all distinctions will be effaced, or that Geography will lose any of its interest or value by its being more closely allied with scientific processes. It would be easy indeed to demonstrate, that within proper limits, such scientific extension brings out new features of utility and interest, showing capabilities in Geography to meet the requirements of commerce and to furnish valuable data for the advance of national objects, without which indeed neither the minister in his cabinet, nor the general in the field, can successfully carry out a national policy in the conduct of foreign affairs. I must, however, content myself with referring you for the best demonstration of this fact, to three addresses delivered in the Geographical Section of the British Association for the Advancement of Science, by members of this Society, in three successive years. I allude to the addresses of Major Wilson, at Belfast, in 1874, of General Strachey, at Bristol, in 1875, and Captain Evans, at Glasgow, this autumn. All of these have been deemed of sufficient interest and importance to be inserted in our 'Proceedings' for the information of the Fellows, but I would still beg to be allowed to again commend you in connection with our proposed action, to give them the attention they so well deserve on other grounds. Major Wilson, taking for his subject the influence which the physical features of the earth's crust have on the course of military operations, and the consequent importance of the study of Physical Geography to all who have to plan or take part in a campaign, has shown not only by a large and varied field of induction, but by striking examples, drawn from recent history, how great a part Geography in all its branches plays in deciding the issue of military operations, and with them the destiny of nations. How much, indeed, the successful issue of a war, may depend on a previous knowledge of the physical character of the country in which it is waged, may be shown by the whole course of history, and fully justifies the remark that if the fate of a nation may depend on a battle, that, in its turn, may depend on a knowledge of Geography. Not the Geography which merely notes the course of rivers or the direction and height of mountain-ranges, and the distribution of high roads or railways, but all the conditions of soil and climate, of rainfall, and its effects on vegetation, of forest and marsh, and their influences on the health of the district; all circumstances which render the subsistence, march, or sanitary conditions, of large bodies of men difficult or impossible. It may be truly said of more than the Franco-German War, that it was "a war fought as much by maps as by weapons."

If we turn to General Strachey's admirable address on Physical Geography as a science, the whole field of Geographical exploration and research is there effectively dealt with in a comprehensive survey. The able writer was not satisfied to dwell on the practical influence produced by the Geographical features and conditions of the various parts of the earth on the ordinary affairs of men and the world,—or even "the past history and present state of the several sections of the human race, the formation of kingdoms, the growth of industry and commerce, and the spread of civilisation"—though to many these are the aspects of Geographical study which possess the greatest interest. He preferred to treat of the physical causes which have impressed on our planet the present outlines and forms of its surface—which have brought about its present conditions of climate, and have led to the development and distribution of the living beings found upon it. And with this for his theme, he has traced the probable future of Geographical investigation. For although, as we are told, "much yet remains to be done in obtaining detailed maps of large tracts of the earth's surface, yet there is but comparatively a very small area with the essential features of which we are not now fairly well acquainted." From this fact, and others referred to, the conclusion is deduced that "the necessary consequence is an increased tendency to give to Geographical investigations a more strictly scientific direction as the demands for more exact information become daily more pressing." In proof of this, he cites the fact, that the two British naval expeditions which have just concluded their voyages (the *Challenger* and the Arctic ships) were "organised almost entirely for general scientific research, and comparatively little for topographical discovery." So also the great advance made in every branch of Natural Science, while it shows more clearly the interdependence of all natural phenomena, it limits, at the same time, the power of attaining the highest knowledge in more than one or two special directions; and it is the more important that some, among the cultivators of natural knowledge, should direct their attention "to the general relations existing among all the forces and phenomena of nature." In some important branches of such subject, he goes on to show "it is *only through study of the local physical conditions of various parts of the earth's surface, and the complicated phenomena to which they give rise*, that sound conclusions can be established; and this study constitutes Physical or Scientific Geography, which is still more closely defined as a study, the 'true function of which is that of obtaining accurate notions of the manner in which the forces of nature have brought about the varied conditions characterising the surface of the planet which we inhabit.'"

Captain Evans, in the third of these instructive Addresses, states his conviction that "It is to the development of the scientific features of Geography that the attention of voyagers requires now to be mainly directed;" and on the Physical Geography of the sea, which he takes for his theme, he goes on to show first that it is difficult, not to say impossible, to prevent a certain overlapping of scientific boundaries, with the expansion of knowledge, or to "see how the several included branches of Physics can be separated from pure Geographical science." And secondly, how full of practical interest and importance in human affairs is the knowledge of Navigation, and that the impetus first given to deep-sea exploration no doubt was derived from the demand chiefly for commercial interests for electrical telegraphic communication between countries separated by the ocean.

But I must not longer trespass upon your time. I will only add that the arrangements for carrying out all the recommendations of the Committee are not yet completed, but I have the pleasure to announce that General Strachey has consented to give the first of the Lectures this Session on the general subject of Geography in its scientific aspect. Dr. Carpenter will deliver the second, on the Physical Geography of the Ocean, and Mr. Wallace the third, on the Influence of Geographical Conditions on the Comparative Antiquity of Continents as indicated by the Distribution of Living and Extinct Animals. I will only further add that, as regards the contemplated grants, 1st, to assist persons in undertaking special scientific Geographical investigations as distinct from mere exploration in any part of the world; 2ndly, to aid in the compilation of useful Geographical data, and preparing them for publication; and, 3rdly, for making improvements in apparatus or appliances useful for Geographical instruction, or for scientific research for travellers,—the Council will be happy to receive applications for consideration under any of these heads.

The following Paper was then read by the Author:—

On the Buried Cities in the Shifting Sands of the Great Desert of Gobi.

By Sir T. Douglas Forsyth, K.C.S.I.

Among the many objects of interest which attracted our attention during the late Mission to Kashghar, not the least interesting was an inquiry regarding the shifting sands of the Great Desert of Gobi, and the reported existence of ancient cities which had been buried in the sands ages ago, and which are now gradually coming to light.

When Mr. Johnson returned in 1865 to India from his venturesome journey to Khotan, he brought an account of his visit to an ancient city not far from Kiria, and five marches distant from Khotan, which had been buried in the sands for centuries, and from which gold and silver ornaments, and even bricks of tea were dug out.

On the occasion of the first mission to Yarkund in A.D. 1870, we were unable to gather much information, and I observe that in Mr. Shaw's book, 'Travels in High Tartary,' no allusion to the subject is made. Tara Chund, the energetic Sikh merchant whom Mr. Shaw mentions, and who accompanied me on both my expeditions, told me that this exhumed tea was to be found in the Yarkund bazaar; but as our stay in that city in 1870 was of very short duration, and we had no opportunity of moving about and making inquiries for ourselves, we returned to India with very vague ideas on the subject. On my second visit in 1873, I determined to make more searching inquiries, and for this purpose I endeavoured to collate all the information obtainable from published works, as well as from Oriental books, such as Mirza Haidar's 'Tarikhi Rashidi,' a valuable copy of which I picked up in Kashghar. I also consulted many natives of the country, and other authorities. And the first of all authorities unquestionably is Colonel Yule. Not only has this distinguished Geographer, by his laborious researches and translations, thrown a flood of light on the history and Geography of Central Asia, and given to the world an invaluable commentary on the travels of Marco Polo, and other mediæval explorers, but I gladly take this opportunity of recording the deep obligations under which he placed myself and all the members of the Mission to Kashghar by the valuable hints and information he supplied to us from time to time. To him I was indebted for the loan of a copy of Rémusat's 'Histoire de la Ville de Khotan,' a most useful work. Colonel Yule very justly remarks, regarding the great Venetian traveller of the middle ages, that all the explorers of more modern times have been, it may be said, with hardly a jot of hyperbole, only travelling in his footsteps; most certainly illustrating his Geographical notices.

It is only proper then to place Marco Polo at the head of the list of authorities to whom I shall refer. The 36th and three following chapters refer to the country in which we are at present interested. His chapter on Khotan is provokingly meagre, for there is very great interest attaching to this place. It is supposed by some that this city was the limit of Darius's conquest. I have several Greek and Byzantine coins which were found in the ruins of the city near Kiria.

We know that in early ages it was inhabited by political exiles from India, that the Hindoo religion flourished there; and I have some gold ornaments found there, which are exactly the same as those worn by the Hindoo women of the present day. In Rémusat's History we read how the King of Khotan took an army across the Snowy Mountains and attacked the King of Cashmir, and how peace was made between the two countries, and the result was that certain Rahans or Ascetics brought the Buddhist religion into the country; and in the 'Tarikhi Rashidi' we read how a Christian Queen, wife of Koshluk, ruled in the land and made proselytes to her religion.

I will not enlarge now on the frequent intercourse in former ages between Khotan and India; but I may, however, here correct an erroneous impression which was conveyed to the Members of the Royal Geographical Society at its last Session. A good deal was said regarding the impenetrable barrier raised by the Himalayas, and Colonel Montgomerie said that the only army which ever crossed went from the Indian side and never returned. But, not to refer to invasions of ancient times mentioned by Rémusat, Mirza Haidar, in his 'Tarikhi Rashidi,' gives graphic descriptions of an expedition under Sultan Saïd and his minister, Mirza Haidar, from the Yarkund side, which was very successful, and on the road between the Susser Pass and the Karakorum we passed the wall which had been erected by the Rajah of Nubra to help to assist the invasions of the armies of Khotan and Yarkund.

The 37th chapter of Marco Polo relates to Pein, and it is evident that at that time the city called by that name was in existence. From the geographical description given by Colonel Yule in his valuable notes on this chapter, I should say that Pein or Pima must be identical with Kiria. Colonel Yule's remark regarding the looseness of morals in the towns of Central Asia is doubtless correct, but I record the fact that the present ruler of Kashghar professes to enforce a very strict code of morality. It is peculiar of its kind, but it is supposed to be framed on the Koran, and according to the practice of orthodox Mahommedans, and he would be horrified if he knew that the accommodating rules of the Shias were supposed to prevail in his country. One of his followers once, speaking to me in no measured terms against the Shias, said he would have as much pleasure in slaying a Shia as an infidel, and his language would remind one of the animosity displayed by Catholics and Protestants to each other in days not very long gone by.

As regards Charchan, or Charchand, we got some information from persons who had been there. It is a place of some importance; and was used as a penal settlement by the Chinese, and is now held by a Governor under the Ameer of Kashghar. It contains about 500 houses, situated on the banks of two rivers, which unite on the plain, and flow to Lake Lop. The town is situated at the foot of a mountain to the south, and the river which flows by it is said to come from Tibet.

Captain Trotter has remarked that the exact geographical position of Charchand is not fixed with any degree of certainty; but it is probably about equidistant from Kiria and Kurla, and he gives the marches from Khotan to Charchand, *viâ* Kiria :—

Khotan to Kiria	4 marches =	104 miles.
Kiria to Charchand	14 marches =	280 or 300 miles.
	Total	384 or 400 miles.

Marco Polo describes the whole province as sandy, with bad and bitter water; but here and there the water is sweet. This agrees with the information we obtained, which was that, between Charchand and Lop, there are oases where wandering tribes of Sokpos, or Kalmaks, roam about with their flocks and herds. I was informed that the present Governor of Khotan rode across from Kurla direct in fifteen days, a distance of about 700 miles.

The stories told by Marco Polo, in his 39th chapter, about shifting sands and strange noises and demons, have been repeated by other travellers down to the present time. Colonel Prejevalsky, in pp. 193 and 194 of his interesting 'Travels,' gives his testimony to the superstitions of the Desert; and I find, on reference to my diary, that the same stories were recounted to me in Kashghar, and I shall be able to show that there is some truth in the report of treasures being exposed to view. I give the following from Colonel Prejevalsky's words :—

"The sands of Kugupchi are a succession of hillocks, 40, 50, rarely 100 feet high, lying side by side, and composed of yellow sand. The upper stratum of this sand, when disturbed by the wind blowing on either side of the hills, forms loose drifts, which have the appearance of snowdrifts.

"The effect of these bare yellow hillocks is most dreary and depressing when you are among them, and can see nothing but the sky and the sand; not a plant, not an animal is visible, with the single exception of the yellowish-grey lizards (*Phrynocephalus* sp.), which trail their bodies over the loose soil, and mark it with the patterns of their tracks. A dull heaviness oppresses the senses in this inanimate sea of sand. No sounds are heard, not even the chirping of the grasshopper; the silence of the tomb surrounds you. No wonder that the local Mongols relate some marvellous stories about these frightful deserts. They tell you that this was the scene of the principal exploits of two heroes -Gissar Khan and Chinghiz Khan. Here these warriors fought against the Chinese, and slew countless numbers, whose bodies God caused the wind to cover with sand from the Desert. To this day the Mongols relate, with superstitious awe, how cries and groans may be heard in the sands of Kugupchi, which proceed from the spirits of the departed; and that every now and then the winds, which stir up the sand, expose to view different treasures, such as silver dishes, which, although conspicuous above the surface, may not be taken away, because death would immediately overtake the bold man who ventured to touch them."

When I was at Peking last spring I had the good fortune to meet Dr. Bretschneider, physician to the Russian Legation, an accomplished Chinese scholar, whose Notes on Chinese mediæval travellers to the west contain valuable information. One of these travellers, Kin Ch'ang-chun, thus writes of his journey across the Great Desert in A.D. 1221:—"Whoever crosses that place in the daytime and in clear weather (*i.e.* exposed to the sun), will die from fatigue, and his horses also. Only when starting in the evening, and travelling the whole night, is it possible to reach water and grass on the next day by noon. After a short rest, we started in the afternoon. On our road we saw more than a hundred sandhills, which seemed to swim like big ships in the midst of the waves. The next day, between 8 and 10 o'clock in the morning, we reached a town. We did not get tired travelling at night-time, only were afraid of being charmed by goblins in the dark. To prevent the charms, we rubbed the heads of our horses with blood. When the master saw this operation, he smiled, and said goblins flee away when they meet a good man, as it is written in the books. It does not suit a Taoist to entertain such thoughts."

One thing strikes me as remarkable, that though, as I suppose, Marco Polo visited Khotan, and passed along the road to Lop, he nowhere mentions the report of buried cities being in existence. Mirza Haidar, writing two centuries afterwards, alludes to them; and we learn from Chinese authorities that they were known to have been buried many centuries before Marco Polo's time.

Before passing to other authorities, I may make a remark on one of Colonel Yule's Notes on this chapter. He speaks of the cities of Lop and Kank. But this Kank is, I think, probably the Katak mentioned by Mirza Haidar. The word in Persian is written کٮک, and it depends on the diacritical points in the middle letter whether it is کتک (Katak) or کنک (Kank). In the copy of the 'Tarikhi Rashidi' I have it is Katak, and this is the version adopted by Dr. Bellew.

Mirza Haidar gives an account of the destruction of this city of Katak. According to him, the fate of the city had long been foreseen in the gradual advance of the sand; and the Priest of the city repeatedly warned his audience, in the Friday sermons, of the impending calamity: and, finally, seeing the danger imminent, he informed his congregation of a Divine order to quit the city, and flee from the coming wrath of God. He then formally bid them farewell from the pulpit, and forthwith took his departure from the doomed abode. He left the city, it would seem, in a violent sand-storm, and hurried away with his family, and such effects as he could carry with them. After he had gone some way, one of his companions (the muezzin, or crier to prayer of the mosque) returned to fetch something left behind, and took the opportunity to mount the minaret, and, for the last time, chaunt the evening call to prayer from its tower. In descending, he found the sand had accumulated so high up the doorway that it was impossible to open it. He consequently had to reascend the tower, and throw himself from it on the sand, and then effect his escape. He rejoined the Sheikh at midnight; and his report was so alarming, that they all arose and renewed their flight, saying, "Distance is safety from the wrath of God."

Such is the story told by a pious Mahommedan regarding the evil consequences of rejecting Islam. But a similar tale is told by the Chinese of another town, at or near Pima, which was destroyed in a somewhat similar manner in the sixth century A.D., in consequence of the neglect of the worship of Buddha. On that occasion, it is said, that there was a violent hurricane for six days, and on the seventh a shower of sand fell and buried at once the whole city.

From the inquiries made by Dr. Bellew, and others of our Mission, it appears that the large town of Lop, mentioned by Marco Polo, exists no longer; but there are numbers of encampments and settlements on the banks of the marshy lakes and their connecting channels, perhaps there are as many as a thousand houses or camps. These are inhabited by families who emigrated there about 160 years ago. They are looked upon with contempt by true believers as only half Mussulmans. The aborigines are described as very wild people--black men with long matted hair, who shun the society of mankind, and wear clothes made of the bark of a tree. The stuff is called "luff," and is the fibre of a plant called "toka chigha," which grows plentifully all over the sandy wastes bordering on the marshes of Lop.

Regarding the present condition of the ancient cities of Lop and Katak, I will here give an extract from the Report of the Yarkand Mission. It is the statement of a Kirghiz of Kakshal, who had travelled over Ila and Kansuh during nearly thirty years, and was in Peking at the time that city was taken by the allied French and English armies in 1860. He had resided as a shepherd for three years at Lop itself. He says (page 46): "There are, besides, two other countries of the Kalmak also called Kok Nor. One is five days' journey north of Orúmchí, and the other is beyond Lop, five days south of Kúchá. This last is continuous with Cháchan on the east of Khutan, and in it are the ruins of several ancient cities, of which nobody knows anything. The principal of these is called Kok Nor. 'Kok Nor' means 'blue lake,' and these several countries are so called because they have such sheets of water in different parts of their surface. But these ruins of Kok Nor I myself have seen. They are on the Desert to the east of the Katak ruins, and three days' journey from Lop in a south-west direction, along the course of the Khotan River. The walls are seen rising above the reeds in which the city is concealed. I have not been inside the city, but I have seen its walls distinctly from the sandy ridges in the vicinity. I was afraid to go amongst the ruins because of the bogs around and the venomous insects and snakes in the reed. I was camped about them for several days with a party of Lop shepherds, who were here pasturing their cattle. Besides, it is a notorious fact that people who do go among the ruins almost always die, because they cannot resist the temptation to steal the gold and precious things stored there. You may doubt it, but everybody here knows what I say is true, and there are hundreds of Kalmaks who have gone to the temple in the midst of these ruins to worship the god there. There is a temple in the centre of the ruins, and in it is the figure of a man. It is of the natural size; the features are those of a Kalmak, and the whole figure is of a bright yellow colour Ranged on shelves all round the figure are precious stones and pearls of great size and brilliancy, and innumerable yámbs or ingots of gold and silver. Nobody has power to take away anything from there. This is all well known to the people of Lop. And they tell of a Kalmak who once went to worship the god, and after finishing his salutation and adorations, secreted two yámbs of gold in his fob and went away. He had not gone very far when he was overpowered by a deep sleep, and lay down on the roadside to have it out. On awakening he discovered that his stolen treasure was gone, though the fob of his debil, or frock, was as he had closed it. So he went back to the temple to get others, but, to his astonishment, found the very two he had taken returned to the exact spot from which he had removed them. He was so frightened, that he prostrated himself before the god, and, confessing his fault, begged forgiveness. The figure looked benignly on him, and smiled; and he heard a voice warn him against such sacrilege in future. He returned to Lop and kept his story a secret for a long time, till a Lamma discovered and exposed him, and he was so ashamed that he left the country."

Now, to come to the manner in which the shifting sands of the Desert have overwhelmed cities and fertile country, I may give my own experience. When I was in Yarkand, in November, 1873, I saw black bricks of tea, old and musty, exposed for sale in the bazaar, and was told that they had come from Khotan. This stimulated my curiosity, and I made inquiry of our friend the Dadkhwah Mahamad Yunus and of our escort, who professed ignorance, alleging that they were almost as strange to the country as the English were to India in the early days of the East India Company. Still, the subject was not lost sight of; and one day, as we were riding over the desert country between Yarkand and Yungi Hissar, I was told that, at a distance of two days' journey, there was a very ancient city buried in the Great Desert. On arriving at Kashghar I endeavoured, but without success (of which more hereafter), to visit Khotan. I received permission, however, to visit the Kum Shahedan, or Oordum Padshah, shrine of the martyrs; and when spending a rather dreary month of expectation at Yungi Hissar, whilst the party I had despatched to Wakhan were occupied in their most interesting exploration, Dr. Bellew and I determined to make a little voyage of discovery on our own account.

Riding for three hours in a north-east direction from the Fort of Yungi Hissar, through a well-cultivated country, to the village of Saigoon, we suddenly were plunged into an arm of the Great Desert. Our route then lay over hilly ground and wide plains. Here and there we saw small wells, covered over with huts to protect them from sand-storms. The water in all was very brackish. At one well there was a tank and kind of hospice, where the man in charge, following the usual custom, came out with a large loaf of black bread on a trencher and offered us tea. At 5 P.M., after a ride of 35 miles, we came to the shrine of Huzrat Begum, the wife of Hussan Boghra Khan, who was killed and buried here just after the defeat of her husband's army, in the middle of the eleventh century. Here we found a regular hospice, with an inner courtyard, and four or five rooms for the better class of pilgrims. Outside were numerous rooms, in a spacious courtyard for common folk, and a separate cluster of houses for the servants of the shrine. The shaikh, or head of the establishment, is Shah Muksood, an old man of eighty-seven, very hale and jovial-looking. He said he had never been beyond the nearest village in his life, and therefore could never have tasted a drop of sweet water. We learned that there was a buried city, or more probably only a fort, not far off, which belonged to Tokta Rashid, an Uighur chief, and had been destroyed by Arslan Khan more than 800 years ago. Starting next morning with spades and pickaxes, we determined to see what remains of former civilisation could be dug up; and, after a weary search, found broken pieces of pottery, bits of copper, broken glass and china, and two coins, one of which is partly decipherable, and appears to belong to an early period. The discovery of glass is remarkable, as scarcely any is used nowadays there, and the art of making it seems to be unknown in Kashghar.

We then rode in a northerly direction to Oordum Padshah. At first the road slopes down to a wide hollow, which drains to the south-east, and there rises up the ridge which we had crossed the day before higher up to the north-west. On the way to this, we passed a number of shallow wells and superficial cisterns on the sides of the road. In all the water was so brackish that most of our Indian cattle refused to drink it. "From the top of the ridge of clay and gravel, which here forms a high and broad bank"—I am quoting the description given by my *compagnon de voyage*, Dr. Bellew—"we got a good view of the Desert away to the east, for the ridge soon breaks up and subsides in that direction to the level of the plain. The plain in that direction presents a vast undulating surface, drained by shallow and very wide water-runs, in which is a thin growth of reeds and rough bushes, but no sign of running water. But to the north it presents a perfect sea of loose sand, advancing in regular wave-lines from north-west to south-east. The sand-dunes are mostly from 10 to 20 feet high, but some are seen like little hills, full 100 feet high, and in some spots higher. They cover the plain, of which the hard clay is seen between their rows, with numberless chains of two or three or more together in a line, and follow in successive rows one behind the other, just like the marks left by wave-ripples on a sandy beach, only on a large scale. Towards the south-east these sand-dunes all present a steep bank in the shape of a crescent, the horns of which slope forwards and downwards in points to the ground. The horns start from the high central part of the body of the crescent, which, in the opposite direction, tails off in a long slant down to the plain. These dunes cover the whole country towards the north and north-west as far as the eye can reach; but towards the east they cease at 4 or 5 miles to the right of our road, and beyond that distance is seen the undulating surface of the Desert.

"From the ridge up to the shrine itself, and next day for some miles further, our path wound amongst and over these sand-dunes. At about 4 miles from the ridge we passed a deserted post-stage, half submerged under the advancing sands. One of the priests of Mazar Hazrat Begum, who was with us as a guide, told us it was called Langar Bulghar Akhund, and said that it was built eighty years ago on an, at that time, open space in the sands, but had been abandoned since thirty years, owing to the encroaching sands having swallowed up its court and risen over its roof. We got down to examine the place, and found the woodwork, and fire-places, and shelves in two rooms, and also a part of the roof in a perfectly fresh and well-preserved state, as if but just vacated. About half the building was buried under a dune, the sand of which stood above the rest of it to a height of 6 or 8 feet; and on each side in rear were much larger dunes, whose regular crescentic form was perfect, and uninjured by any obstruction. At one side of the two rooms still uncovered, and which faced to the south-east, was another room filled to the door with sand, which seemed to have crushed in the roof.

"At Oordum Padshah, where we halted a day, we found some tenements actually occupied whilst in course of submergence; showing that the process is usually a very gradual one, until the symmetry of the dune is so broken by the obstructing object that its loose materials subside by a sudden dissolution of its component particles, and thus overwhelm the obstruction. In this particular instance a chain of three crescentic dunes side by side had advanced in a line across the plain, till one of the outer crescents had struck the walls of the court of the tenement, and, growing up, had in time overtopped, and then overflowed and filled its area by its downfall; whilst the other two crescents at its side, continuing their unobstructed course, maintained their proper form uninjured. The same cause which propelled them gradually forward, also operated to drive the remainder of the broken dune forward, and it would in course of time not only bury the whole tenement, but would ultimately pass beyond it, and resume its original form on the open space farther on, in line with the other two crescents of the chain; thus leaving the tenement more or less uncovered, till it was again submerged by the next following row of similar sand-dunes.

"These sand-dunes are formed by the action of the periodical north and north-west winds, which here blow over the plain persistently during the spring months. And the reason of their progress is this—that once formed, the wind drives forward the loose particles on its surface, so that those on the sides, where there is least resistance, project forwards in the form of long horns, whilst those in the centre ride over each other till they produce the high curved bank between them; and on being propelled still farther, they topple over the bank out of the influence of the wind, but subject still to that of their gravity, which carries them down the steep slope till they reach the ground. And this action continued for a length of time is the cause of the gradual and symmetrical advance of the dunes. The rate of their progress it is impossible to determine, as it depends entirely on the varying force of the propelling power, the slope of the land, and the obstructions on its surface. But the phenomenon as we saw it actually in course of operation explains the manner in which the cities of Lop, and Katāk, and others of this territory, have become overwhelmed in a flood of sand. And it confirms the veracity of the statements made by the shepherds who roam the deserts, to the effect that in these old ruined sites the houses now and then appear for awhile from under the sand, and again for awhile disappear under it. The idea that the process of burial is very gradual, is suggested by the remarks made by Mirza Haidar, and of the probability of this we had a remarkable illustration in the tenement mentioned above, as still occupied at Oordum Padshah, though the court up to its verandah was already full of sand from the dune which had broken over its walls. Had the court in this case been on the opposite side, and the house been the first to pass under the advancing sand, as we saw at the Langhar Bulghar Akhund, it is easy to perceive how, on toppling over the front walls (if it did not suddenly by its weight crush in the roof) it would shut up the inmates in a living tomb.

"That this actually did occur at Katāk in many instances is evidenced by the skeletons and desiccated bodies which are still occasionally seen in unearthed houses, with their apparel and furniture intact and uninjured, as is told with such apparent truth by the shepherds who roam that spot at the present day. The shrine of Oordum Padshah is itself buried in the sand, and poles tufted with yaks' tails mark the spot of the grave. But the monastery, and some almshouses around, are built on small clear spaces on the plain, which appear here and there amongst the heaps of sand, and form as it were lanes, running in the direction of the march of the sand-dunes. Some of the larger dunes, at the distance of 300 or 400 yards off, lie obliquely upon the monastery; but as they seem to advance here at a very slow rate—twelve years having passed since the dune broke into the court of the tenement mentioned without having yet completely filled its area, which is only 10 or 12 paces wide—the confident faith of the venerable sheikh who presides over it may prove justified. 'The blessed shrine has survived the vicissitudes of eight centuries,' he said, in reply to our forebodings of the danger threatening its existence; 'and, please God, it will survive to the end of the world.'"

I was very anxious after this to visit Khotan and examine the ruins which have been exposed to view, but was unable to carry out my project. I, however, sent one of the Pundits, of whom so much has been heard, to travel in that direction, and I employed other trustworthy men to visit the locality. The verbal reports they brought back, each independent of the other, confirmed all I had heard before.

The inquiries of the Pundit referred chiefly to the routes through Khotan to India, and, unfortunately, he did not direct his attention particularly to these cities. But he brought me two figures, which were found in the buried city near Kiria, the one being an image of Buddha, and the other a clay figure of Hunooman, the monkey-god. These had only just been found, and it was fortunate that they soon fell into his hands, for the pious zeal of a Mahommedan iconoclast would have consigned them to speedy destruction. Another man, Ram Chund, whom I had deputed to visit Khotan, brought me some gold finger-rings and nose-rings, such as are worn in the present day by Hindoo women; also some coins, of which the most remarkable are an iron one,* apparently of Hermæus, the last Greek king of Bactria in the first century B.C., and several gold coins of the reign of Constans II., and Pogonatus, Justinus, Antimachus, and Theodosius. According to Ram Chund, the buried cities proper are at a distance many marches east of Khotan; a discovery of buried ruins has, however, lately been made quite close to Ilchi, the chief city of Khotan, at a distance of 4 miles to the north-west. A cultivator, working in the fields, was watering his crop, and found the water disappear in a hole which absorbed it entirely. On digging to examine the hole, he found a gold ornament representing the figure of a cow. News of this reached the ears of the Governor of Khotan, who ordered excavations to be made, and gold ornaments and coins were found. In the month of April, 1874, about the time when Ram Chund was there, a gold ornament weighing about 16 lbs. was found. It was in the shape of a small vase, and had a chain attached to it. Rumour declared it to be a neck-ornament of the great Afrasiab, and the finder was declared to have hit upon the spot where Afrasiab's treasure was buried. This, of course, is all pure conjecture, and Afrasiab, who was father-in-law to Cambyses II., occupies in all Central Asian legends the place taken by Alexander the Great in Asiatic legendary history, or King Arthur in English tales. I hope the time is not far distant when a complete exploration of these interesting ruins will bring to light many more treasures; and it is not only in the neighbourhood of Khotan that these inquiries have to be made.

According to information we picked up from travellers, and confirmed by Syad Yakub Khan, there is a ruined city called Tukht-i-Turan, close to the city of Kuchar, on a hill of bare rock; the ruins are of earth of a deep yellow colour, quite unlike anything on the hill; there are besides a large number of caves, excavated for residence. The city is said to have existed previous to the first Chinese occupation, and to have been consumed by fire owing to the refusal of its ruler to adopt the Mahommedan faith. About 16 tash, or 60 miles, to the north of Kuchar a large idol is said to exist, which is cut out of the rock. It is 40 to 50 feet high, has 10 heads and 70 hands, and is carved with the tongue outside the mouth. The mountain behind the idol is exceedingly difficult of ascent; game abounds, but, owing to the protection of the idol, cannot be killed. Some very remarkable ruins are said to exist not far from Mural Bashi. Syad Yakub Khan gave us a description of them, but unfortunately not till after Captain Biddulph had visited the vicinity without being aware of the prize almost in his grasp.

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* Probably the iron coin of Hermæus may prove to be the oldest, but it has not yet been completely deciphered. The Antimachus is about 140 B.C. and the Menander 126 B.C. The little figure of Buddha is pronounced by competent authorities to be about the 10th century, so that the submergence of this city in the sand may be dated about 800 years ago.

Not far from the present city of Kashghar is the Kohna Shahr, or old city, which was destroyed many centuries ago, yet the walls, though only built of sun-dried bricks, are standing, with the holes in which the rafters were inserted as clearly defined as if they had been only just used. They reminded me of the holes to be seen in the rocks on the Danube just before approaching the Iron Gates. As all, or nearly so, of the edifices in Central Asia are built of sun-dried bricks, it may seem remarkable that such structures should survive through so many ages, but the extreme dryness of the climate accounts for this. When I was staying at Yungi Hissar, I visited the tomb of Hussan Boghra Khan. It is recounted on his tomb how he had earned the crown of martyrdom by falling in battle against the infidel King of Khotan, whose fort, which stood close by, he had destroyed. I went to see the fort, and found not only part of the woodwork in good order, but even the matting which is put under the earthwork of the eaves of the roof was still visible. According to the date on the tomb, this fort must have been destroyed upwards of 800 years ago.

An interesting question may now be asked: Where do these sands come from? It is a remarkable fact, well supported by the evidence of our senses, as well as by the reports of the inhabitants of the country, that all these sand-hills move in one direction, *i.e.* from north-west to south-east. If I were speaking of a tract of country east of the Great Desert of Gobi, the answer of course would be plain; but I am speaking of the extreme west corner of the Desert, and, moreover, I will endeavour to describe a still more remarkable circumstance. As we left Kum Shahidan on our return journey we took a westerly direction, and after crossing a sea of sand-hills for some miles came to cultivated ground, which we again exchanged for sand. Judging from what we saw, our theory was that these sands are all gradually moving on, and the parts we saw cultivated will in time be overwhelmed, and other parts now covered will be laid bare. But, following this course for some miles, we should have come to the Tian Shan Range. Does all this sand come from that range? One idea started was that the sand comes from the great deserts in Russian Siberia, over the Tian Shan Mountains. Another idea is that it is raised in the

Desert of Gobi, and is carried by a current of air round the basin of Kashgharia.

The idea of the sand coming from the range which immediately bounds the Desert cannot be maintained, I think. For the sand is blown always in one direction, and the particles are very much heavier than the very fine impalpable dust which fills the atmosphere with a haze as dense as a London fog, and which is doubtless raised by the various gusts of wind from the mountains on all sides. The dusty haze falls all over the land, but is not sufficiently thick to bury buildings.

The theory that the sand is brought from a desert in Russia is also, I think, untenable. It would have to pass over Issyk Kul and other lakes and cultivated land, which we know are not thus covered with sand. It would, in fact, have to mount high in the heavens, like a flock of geese, till it crossed the lofty Alai or Tian Shan Mountains, and then alight on the Desert of Gobi, sand being thus attracted to sand.

The third theory, of a circular current of air, seems more probable. I have seen, on a small scale, something of the same appearance on the elevated plateau, crossing from the Chang-chen-mo Valley to the head of the Karakash River, on the large soda or alkali plain, which is, in fact, the dried-up bed of an old lake, and is surrounded by low hills. When I was encamped in a ravine, about 5 miles from this plain, I observed about 2 P.M. that a dense cloud of white mist rose from the plain. A local dust-storm of a very disagreeable character seemed to be going on. But it did not spread, and next morning when we crossed the soda plain all was quiet. Towards afternoon, however, a storm, similar to what we had witnessed the day previously, came on, and I believe such storms are of daily occurrence, except perhaps in winter. Some of my party, in crossing the plain, came across the remains of the animals and some camp articles, too, partially buried, which, it was said, had been lost or left by Adolphe Schlagintweit in 1857. Now, what I saw there on a small scale may be going on, on a much grander scale, in the large basin of the Desert of Gobi. I may mention here that, in crossing from San Francisco to New York, I observed that the plateau between the Nevada Range and Rocky Mountains is very similar in its features to parts of Central Asia, and especially to the high regions between the Karakorum and Yarkand.

I have said that an attempt made by me to pay a visit to Khotan was unsuccessful, and this leads me to notice the remarks of a writer in the July number of the 'Quarterly Review,' who gives his opinion that had the surveillance and restraint to which, under the guise of attentions, the Mission was subjected been resisted successfully at the beginning, and had not time been unaccountably lost, a much more extensive exploration of this interesting country might have been made. This able reviewer had probably not travelled in Asiatic countries, or he may have forgotten his knowledge of Asiatic character, and has not weighed sufficiently carefully the responsibilities which fetter those who have the conduct of such an expedition as I had the honour to command. But as the opinions he has thus expressed have been shared by others, who, with an imperfect knowledge of the whole circumstances of our position, have chafed at the loss of apparently easy opportunities for adding to our stock of knowledge, I may here say a few words which will perhaps throw some light on the matter, and explain what the reviewer considers to be unaccountable negligence on my part. However friendly an Asiatic may be, he is proverbially suspicious of the actions of all foreigners. Mr. Shaw, to whom, as the Quarterly Reviewer justly remarks, is due the honour of the first successful advance into that long closed country, as is duly related in his 'High Tartary, Yarkand, and Kashghar,' an interesting record of his adventures and of difficulties overcome by a happy mixture of boldness and diplomacy with patience and good humour, gives instances of the disappointments to which he was subjected, and he has often recounted to me the manner in which he was tantalised with expectations of immediate liberty of action, but always to be disappointed at the moment of fruition. During his first visit to Yarkand and Kashghar he was kept a prisoner inside the four walls of his house or in his tent, and never entered the city at all. This was, however, a circumstance in no way to be wondered at; but when he revisited the country as the Political Agent deputed by the Indian Government, and after the return of our Mission, when he might be sure of enjoying the fruit of newly established relations with the Ameer, I fully expected that he would travel about the country and accomplish what we had left undone. But it is a fact that Mr. Shaw did not even enter the city of Kashghar, although he resided for several months within a few miles of the city. He has never been inside it or beyond Yungi Shahr, the old Chinese quarter now occupied by the Ameer, and 5 miles distant from the city. The reason he gave me for this was that though he doubtless might have insisted on going there, he abstained from doing so out of deference to the known or supposed feelings of the Ameer; and if in such a small matter he considered it polite to abstain from exercising an

Englishman's propensity to satisfy his curiosity, I feel that I have a strong authority on my side. To anyone unacquainted with the *character of these Asiatics, their conduct is often inexplicable,* and most trying to one's patience. Mr. Shaw recounts how the Yarkand officials would come to him in his confinement and propose a visit to the city, or to some gardens in the neighbourhood, and having excited his expectation to the highest pitch, and having gone so far as to fix the time for going and all preliminaries, they would raise some hidden and insuperable objection. I found exactly the same process adopted with reference to myself. On the occasion of my first visit to Yarkand, in 1870, the Dadkhwah made the usual offer of perfect liberty of action, but was mightily offended because I took him at his word. On the second visit, I arranged through my friend Syad Yakub Khan for complete liberty to be accorded to the members of the Mission to roam about anywhere within a day's journey of our quarters, leaving more extended excursions to be matter of separate arrangement. We had not been lodged in Kashghar a week before we obtained the permission of the Ameer to visit the frontier fort of Ckakmah. Captain Biddulph was allowed to go on an excursion to Maralbashi, and as soon as the weather permitted we took a journey up towards Ush Turfan. During the winter months very extended journeys could not be undertaken; but I was consequently consulted as to my wishes for sending a party to Aksu and to Lake Lop, as well as to Khotan. The Ameer volunteered to make use of Dr. Stolitzka's valuable scientific knowledge, and after having received his report, or specimens of coal, copper, and other ores, proposed that he should be sent to examine the mines. But, as in Mr. Shaw's case so it was in ours; just at the last moment some excuse was raised, and the expedition had to be postponed *sine die.* I find that another great traveller (M. Prejevalsky) details experience similar to ours, and complains of being detained just at the moment of departure, for reasons which he could not discover either then or afterwards, and Schuyler, in his most interesting work on 'Turkestan' records similar experiences, and I am inclined to think that all European travellers in Central Asia are likely to suffer in the same way until they can discover the secret which the reviewer apparently possesses for overcoming these obstacles. The important journey to the Pamir by Colonel Gordon's party required considerable negotiation on my part; and after it had started, the Ameer sent word to recall it, and I had some difficulty in reconciling the Ameer to Colonel Gordon prosecuting his journey. My application to visit Khotan, after having been sanctioned and every arrangement having been made, was, finally, flatly refused; and had I insisted on having my own way, it is most probable that I should have found insuperable difficulties put in my path, and it is certain that I should have caused a breach in the friendship it was my object and duty to cement.

Possibly it may be said that all this only shows the hollowness of the Ameer's performance of friendship; and, in fact, I have frequently seen this urged as a proof of the worthlessness of any treaty of amity with the rulers of countries across our border. But I take leave to differ entirely from such opinions. We cannot judge Asiatics as we would Europeans. They do not understand expeditions conducted for purely scientific purposes; and they may be excused for disliking to show all their resources even to their most valued European friends. I cannot do better than conclude my Paper by a quotation from the remarks made by the distinguished President of the Royal Geographical Society:—"We must complain that our reputation in the East takes its complexion from our conquests and progress in India, the history of which, in broad outline, at least, is perfectly well known in China, if not all over Asia. How we began by asking for a privilege for trade, and ended by annexing provinces, after disastrous wars, is no secret. Whatever explanations or defence we may have to offer as to the causes of this inevitable advance from trading factories to Empire, we can scarcely expect any Eastern sovereign or people to attach much credit to them. We must be content to trade and to negotiate, weighted with the heavy burden of distrust and suspicion.

Mr. H. H. Howorth said, as he was at present engaged in writing the second volume of 'The History of the Mongols,' he had been brought into immediate contact with the very interesting problems connected with the history and topography of the districts to which Sir Douglas Forsyth had referred, and which it was well known formed one portion of the great Mongol Khanate of Jagatai Khan. Those districts were more surrounded with romance to ethnologists than any other portion of the earth's surface. Lake Issikul he believed was the focus of the home-land of the Turks, and all their early traditions centred around its borders. A great number of students also regarded the country to the south as the home-land of the Aryan races. Whether this was so or not, the district was the frontier separating the Turanians from the Aryans at the present moment, and in olden times undoubtedly it was occupied by an Aryan race. He had lately returned from St. Petersburg, where he met the great Chinese scholar, Professor Wasilief, who frequently spoke to him about this region, and said that, after a great deal of patient research, he was quite convinced that whatever civilisation there was in China was originally derived from the Aryans; and if so, it must have been from Aryans who occupied this particular district. It was therefore extremely interesting to find there, remains which pointed to the presence of a race which certainly all the Chinese accounts which had been translated by Rémusat and others seemed to show were Aryans. He therefore looked with the greatest possible interest and pleasure to the time when some of these remains would be accessible to the examination of scholars. The traditions of the people in the district seemed to point to some of the remains being of the period of Arslan Khan. He supposed that meant that they belonged to the dynasty of the so-called Kara-Khanids, all of whose kings were styled Arslan Khan, or Lion Khan. Professor Grigorief had written a very interesting paper on this subject, in which he had thrown considerable light on the old chiefs who reigned at Kashghar from the ninth to the eleventh century. The Russian authorities connect these princes with the Karluk Turks. One fact, which was new and rather startling to him, in the Paper was the evidence of the presence of Buddhism in the district so early as the beginning of the Christian era. Professor Lerch of St. Petersburg, who had written an admirable topographical paper on the Jaxartes, had told him that he had found a Buddhist tomb of perhaps the sixth century in the country to the west of Uzkand, while the earlier of the Chinese Buddhist pilgrims who passed this way carry us back to the fifth century. But the presence of Bactrian and Indo-Scythic coins in this district, with Buddhist statuettes, carries back the story much further. In connection with these buried cities which Sir Douglas Forsyth had described, it was impossible not to think of the destruction of the cities by sand to the west of the Oxus, on the old channel of that river. A good deal further north, in the region occupied by the Ostiaks and the Samoieds, there are also underground remains, which the people point to as the habitations of their ancestors, and which they say are constantly marked by curious sounds, as of animals travelling underneath. In an old Arabic account of the ninth century, mention is made of the presence of griffins in this district; and some years ago, in the old treasury of St. Denis, a horn was discovered which had been presented to one of the kings of France by Harun al Raschid as the horn of a griffin; but it turned out to be simply a fossil horn of a rhinoceros. In conclusion, he expressed a hope that some portion of the Society's funds and energy would be directed to the publication of other matter than mere travels, and that they would assist to make accessible more of the work that was done in Russia. No greater work could be done than a translation of the Russian edition of Ritter's 'Asia.' The collection illustrating ethnology in England might also be greatly enlarged, and made worthy of our wide commerce and interests if Geographers would remember that we have a very fine national collection, partially exhibited in the British Museum and partially at 103, Victoria Street, whose indefatigable curator was unsurpassed for knowledge in Europe. He hoped that travellers who brought home objects illustrating savage life would take them there, rather than allow them to be lost or broken in private houses.

Sir H. RAWLINSON stated that it was probable that, very shortly, some further interesting information would be obtained with regard to the district described by Sir Douglas Forsyth, as during the conference at Brussels he was assured by Baron Richthofen that Colonel Prejevalsky was on the point of leaving Kulja for Kara-shahar with the intention of proceeding direct to Lake Lob, where he expected to spend Christmas Day. In the letters which Prejevalsky had written from Kulja he announced that he was satisfied that in Lake Lob was to be found a flourishing Russian colony. He stated that he had obtained authentic information that about one hundred years ago a number of Russians escaped from Siberia, and established themselves on an island in Lake Lob. They formed a flourishing colony there, and their numbers had been augmented by other refugees. One of the great objects of his present journey would be to open up communication with those people, who possibly might be the same as those to whom Sir Douglas Forsyth had referred. He (Sir H. Rawlinson) had listened with great interest to the paper, and cordially agreed with most of the views there advanced. He might be able to make a few verbal criticisms, but he by no means claimed to have inherited the mantle of Mr. Crawfurd, who had been called "The Objector General," and would only therefore take exception to the word "Katak," which he believed to be a wrong reading. He had consulted four copies of the Tarikhi Rashidi, and Quatremère had consulted others, and in all of these MSS. the word was Kanak. Whether the name, however, of this particular ruined site was Katak or Kanak, it was a very interesting fact that there were old buried cities in that region exhibiting marks of Indian influence. At the same time he did not think it had been sufficiently considered that the Aryan inhabitants of India came originally from the country described by Sir D. Forsyth, and were rather recent visitors to India. No doubt Khotan was one of the very earliest settlements of the Aryan race and one of their main points of civilisation. Its real name was Koustana, and it was probably pressure from the Turanian races from the north-east that drove the Aryans from Koustana down upon India, where they found an aboriginal population, neither Aryan nor Turanian, whom they gradually displaced. Therefore, when marks of Indian influence were found in Central Asia, he did not consider that such marks were derived from India, but were rather the relics of the old race who had descended upon India; for he was not aware that there had ever been any ethnic reaction from India to the northward. He would also recall Sir Douglas Forsyth's attention to the city of Pein, which Marco Polo alluded to. That place was not entirely unknown to Geography, for independently of the Chinese pilgrims of the seventh century, who described it under the name of Pi-mo, the city of Pein was also distinctly laid down in a Turkish map of Central Asia, printed in Constantinople (in the *Jehán-namá*) about 250 or 300 years ago. He had never been able, it is true, to learn where the author had obtained his information. A Turk at Constantinople would hardly have laid down a city as a sister capital to Yarkand and Kashghar upon the authority of Marco Polo, of whose existence he could hardly have heard, yet no other Moslem Geographer had mentioned Pein. Sir Douglas Forsyth's paper was a most excellent and valuable one, and had drawn attention to a very interesting and important subject, not only as regards the Geography, but also the Ethnology of Central Asia.

Colonel H. Yule did not consider that the identification of the remains as Hindoo necessarily proved identity of race with the inhabitants of India. It simply proved the extension of the Hindoo religion to that country at a very early date; and this former great extent of Hindoo influence was a circumstance that had struck him forcibly in listening to the present Paper. There was some reason to suppose that the cities which were destroyed near Lake Lob were also subject to the influence of Hindoo religion. The Chinese traveller Hwen-Tsang, in the seventh century, mentioned one of them under the name of *Navapa*, which appeared to be a Sanskrit name, and might easily have been modified popularly into Lob or Lop, the name given by Marco Polo to a city in this region, and mentioned by other writers. Sir Douglas Forsyth spoke as if he felt confident that the mountains to the north of India had been habitually passed in ancient times; but it was probable that the intercourse always mainly was by the circuitous but easier route across the Pamir, which had been the great pass from Western to Eastern Asia through all history. Hindoo influence was found almost as far west as the Caspian. Some of the old Arab historians or geographers stated that the name of the great city of Bokhara signified a place of instruction, and he himself had a strong impression that it was nothing but the Buddhist *Vihârâ*, a monastery or temple, and that that centre of Mohammedan bigotry was, in fact, originally a settlement of Buddhist monks among the marshes of the Zarafshan. This Hindoo influence then was found spreading to Lake Lob, and eventually to China, and west to the Caspian, and east to the Islands of the Moluccas. It had also spread, though in a commercial rather than a religious form, down the coast of Africa to about the 20th degree of south latitude. Another point that struck him in looking at the map now displayed was the prodigious progress that had been made in our knowledge of Central Asia since he first entered the service. At that time none of the country from the Sutlej to the extreme north of Turkestan was decently mapped. Nearly all that appeared then in our maps of this vast tract was little better than more or less judicious conjecture, founded on literary materials that did not exclude Marco Polo, hardly even Ptolemy; with some very scanty and fragmentary aid from the Jesuit observations of last century; but at present only a small part, chiefly the central portion near the banks of the River Tarim, remained unexplored.

The PRESIDENT regretted that the lateness of the hour prevented a continuation of the discussion of so suggestive a subject. To himself the paper had been one of intense interest, both ethnographically and historically. He had long been in the habit of believing that physical laws very much governed the distribution of races, and it now appeared that the sand-dunes of Central Asia swept down from the north-west to the south-east just as the Russians had been doing for the last two hundred years. Was there any natural law that determined this? In conclusion, he expressed the acknowledgments of the Meeting to Sir Douglas Forsyth, and the proceedings then terminated.

Second Meeting, 27th November, 1876.

SIR RUTHERFORD ALCOCK, K.C.B., PRESIDENT, in the Chair.

ELECTIONS.—*Prof. Cavaliere Enrico H. Giglioli*; *Eugene Schuyler* (Secretary to the United States Legation, Constantinople). } *Hon. Correspond. Members.*

John Alstone, Esq.; *Thomas R. Arnott, Esq.*; *E. T. Atkinson, Esq.* (Indian Civil Service); *Arthur Edmund Ball, Esq.*; *Frederick H. Balfour, Esq.*; *Thomas Bell, Esq.*; *W. M. Bickerstaff, Esq.*, J.P.; *A. Bowden, Esq.*; *William Bowman, Esq.*, F.R.S.; *William John Chetwode Crawley, Esq.*, LL.B., F.G.S., &c.; *Augustus Champion De Crespigny, Esq.*; *P. Dekeyser, Esq.*; *Ernest A. Floyer, Esq.*; *Lord Garvagh*; *George Green, Esq.*; *Arthur Gunn, Esq.*; *Abdul Hakk Karnalkar*; *Navg.-Lieut. George C. Hammond*, R.N.; *John Hassard, Esq.*; *Edward Herries, Esq.*, C.B.; *Major Bertie Hobart*, R.A.; *Capt. Edward O. Hollist*, R.A.; *Charles C. Howard, Esq.*; *Thomas Manson Rymer Jones, Esq.*, C.E.; *Matthew Kane, Esq.*, M.D.; *James Laming, Esq.*; *Rev. Henry Lansdell*; *Hon. John Hamilton Lawrence*; *Edwin B. Lethbridge, Esq.*; *Alex. Fownes Luttrell, Esq.* (Lieut. Gren. Gds.); *George de L. Macdona, Esq.*; *Robert Allan McLean, Esq.*; *N. H. Nahishima, Esq.*; *Edwin H.*

Newby, Esq.; Colonel John Pigott Nixon (Consul-General and Political Agent for Turkish Arabia); *Joseph Pearcy, Esq.; Sir Rose Lambert Price, Bart.; Mirza Mohamed Rahun; Richard C. Rapier, Esq.*, C.E.; *J. T. Robinson, Esq.; Harry G. Seeley, Esq.*, F.L.S., F.G.S., F.Z.S., &c.; *Dr. Thomas Somerville*, LL.D.; *Capt. Leopold Victor Swaine; Staff Commander J. H. Tizard*, R.N.; *Henry Ullyett, Esq.; Lieut. Robert Horace Walpole*, R.N.; *Christopher Ward, Esq.*, F.L.S.; *O. C. Waterfield, Esq.; J. C. Webb, Esq.*, M.D.

DONATIONS TO THE LIBRARY, FROM 13TH TO 27TH NOVEMBER, 1876. Notes of a Voyage in Turkey and Persia, 1848—1852, by the late General Tchirikoff, Russian Commissioner for defining the Turco-Persian Boundary, by M. Gamazoff (in Russian); St. Petersburg, 1875 (*M. Gamazoff, per Captain Clarke*). Handbuch für Reisende, Ægypten, I., edited by K. Baedeker; Leipzig, 1877 (*Editor*). Report to the President of the United States, 'Polaris' Arctic Expedition (*Chief Justice Daly*). Zur barometrischen Höhenmessung, von J. Hann; Wien, 1876 (*Author*). On Prehistoric Names of Weapons, by Hyde Clarke, 1876 (*Author*). Education and Culture, by A. Mackennal; Leicester, 1876 (*Author*). Official copy, Tide-tables for 1877 (*Lords Commissioners of the Admiralty*). Gumpel's Patent Rudder, 1875 (*S. M. Drach, Esq.*). The Indignation Meetings of Liberals, and conduct of affairs in the East, 1876 (*Anon.*). Ueber die Nothwendigkeit des Waldschutzes für die schiffbaren Ströme Russlands, &c., von G. von Helmersen; St. Petersburg, 1876 (*Author*). Tableaux de population, &c., pour l'année 1874; Paris, 1876 (*The French Colonial Minister*). Ueber die Malayische Säugethier-Fauna, von A. von Pelzeln; Wien, 1876 (*Librarian*). K. Svenska Fregatten Eugenies Resa omkring Jorden, Häft. 4, 5, 9, and 12, in completion of the work so far as issued (*The R. Swedish Academy of Sciences*); and the current issue of publications of corresponding Societies, Periodicals, &c.

The PRESIDENT said the Papers on the programme for the evening meeting all related to Central Africa, a subject of increasing interest at the present time in consequence of the International Conference at Brussels. Great efforts were about to be made for the exploration and civilisation of Central Africa, and on a larger scale than had ever before been attempted. The Papers to be read all referred to the results of the Expedition of the Khedive to the region of the Nile Lakes, and in connection with this he wished to draw attention to a summary of the Geographical and Scientific results of the Khedive's recent Expeditions, which had been received by the Society, and would be published in the 'Proceedings.' * There had been no less than twenty-seven important results and discoveries attendant on these Expeditions, and it was impossible to speak too highly of the liberal expenditure and enlightened interest with which the Khedive had provided for the purely Geographical and Scientific aspect of these undertakings. Two of the Papers to be read had been received from General Stone, the intelligent Chief of the General Staff at Cairo, and it was very gratifying to note the zeal and promptitude with which General Stone was carrying out the Khedive's orders to afford the Society the earliest possible information with regard to everything that was done by these Expeditions. Since Signor Gessi's return from his navigation of Albert Nyanza, Colonel Gordon, in July of this year, ascended to the Lake in the little steamer *The Khedive.* The world was indebted to Signor Gessi, under the direction of Colonel Gordon, for one of the most valuable discoveries in connection with the course of the Nile and the lakes that had been made of late years. While it was being disputed whether the Nile really issued from Albert Nyanza or not, Signor Gessi settled the point by sailing his boat right up the river into the lake.

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* Vide p. 63, infra.

Whilst on the subject of African exploration, he (the President) wished to express the deep regret with which the Society had recently heard of the death of Mr. Rebmann, one of the East African missionaries who originally called attention to the system of great lakes of Central Africa. He was sent, in the year 1846, by the Church Missionary Society to join their missionary, Dr. Krapf, in East Africa. He accompanied Dr. Krapf in most of his travels in Eastern Africa, and they together discovered the snow-covered mountains Kilimandjaro and Kenia, for which, in the year 1852, they received the Silver Medal of the French Geographical Society. In their journeys in 1851 the missionaries met with a merchant from a country to the north-east of the River Dana, who affirmed the existence of a great lake called Baringo. Various reports continued to reach the missionaries Krapf, Rebmann and Erhardt, that all travellers travelling west from different starting points along 6 degrees of the coast eventually arrived at a Bahari or inland sea. The map furnished by Erhardt and Rebmann was laid before the Royal Geographical Society, and the result was the first expedition of Captains Burton and Speke. Captain Speke, in his great work 'The Nile Sources,' says: "I must now call attention to the marked fact that the missionaries residing for many years at Mombasa are the prime and first promoters of this discovery." And he concludes with the following remarkable words: "The good that may result from their map will, I trust, prove proportionately as large and fruitful as the produce from the symbolical grain of mustard seed, and nobody knows or believes in this more fully than one of the chief promoters of this exciting investigation, Mr. Rebmann. From these late explorations he feels convinced, as he has oftentimes told me, that the first step has been taken in the right direction for the development of the commercial resources of the country, the spread of civilisation, and the extension of our geographical knowledge." Mr. Rebmann continued at his post labouring unremittingly in the reduction of three of the principal languages of Eastern Africa, until, totally blind, he returned home in 1875, rejoined his old companion Krapf in Germany, and they together were engaged in passing through the press Mr. Rebmann's 'Dictionary of the Kiniassa Language,' when, after a short illness, he died at Kornthal near Stuttgart.

The following Papers were then read:—

1. *Observations on the Nile between Dufli and Magungo.*

By Colonel C. E. Gordon.

[Communicated by General Stone, Chief of the General Staff, Cairo.]

At the distance of about 20 miles to the south of Dufli the river begins to widen out, and the current becomes therefore less rapid;

and from that point to Magungo the river is nothing more than a portion of Lake Albert. The current is very slow, not more than half a mile per hour; the bed is wide, sometimes as much as two or three marine miles, and it is filled with islands of papyrus. The banks of the river are fringed with papyrus, and are difficult of approach. The country is very populous—much more so than any other portion of Africa that I have seen—and the natives are well disposed. They were greatly astonished at the sight of the steamboat. Banana cultivation is met with at a distance of 40 miles to the south of Dufli, and it continues on south for 20 miles, when it ceases, and is not met with again until the Lake is neared, when it reappears. I do not know the cause of the interruption in the banana cultivation. At the distance of 50 miles to the south of Dufli the natives wear each a skin, farther on they clothe themselves with the bark of a tree. I believe that, taking Ratatchambé as a centre, and describing a circle with a radius reaching to Fashoda, that circle would include all the tribes that go entirely naked—a zone outside of that circle would include those half clad—and a zone outside that would contain the tribes who fully clothe themselves.

I have not seen the branch which leaves the Nile and flows to the north-west, according to M. Gessi; having troops with me, I could not delay my voyage to make close examinations of the country, but I do not doubt of its existence. I have found Sir Samuel Baker's map quite correct for the northern portion of the Lake. The mouth of the Victoria Nile is very difficult to find, the whole coast being sown with papyrus islands; there are thousands of them, and one can hardly say where the Lake ends and where the river begins. There is no current, and the water is shallow. One can hardly conceive the number of villages (Zeribahs) which exist on the left bank of the river. In this it resembles the Shillook country in former days. The Lake has a sad and deserted appearance, and the country around is very uninteresting.

The steamboat ran very well, and from what I have seen is sufficient for the service.

2. *Notes on the Victoria Nile between Magungo and Foweira.*

By Colonel C. E. Gordon.

[Communicated by General Stone, Chief of the General Staff, Cairo.]

From Magungo to Murchison Falls the River is navigable, and the current does not exceed one knot per hour; but from that point to the Karuma Rapids, 9 miles below Foweira, the river is full of strong rapids. The country is almost deserted by man. The banks of the river are bordered by trees. In a word, it is a wilderness. It seems that the Nile runs through a plateau from Foweira to Murchison Falls. Then, in a space of 10 or 15 miles, it has a fall of 700 feet. The rapids near Foweira are strong, but between them the river flows tranquilly. It is within the 10 or 15 miles' space above alluded to that the waters fall most.

Nothing can describe the solitude of this deserted country. The wars between Kaba-Rega and Aufina have prevented the natives from settling in the territory thus subjected to invasions from both directions.

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3. *On the Circumnavigation of the Albert Nyanza.* By Romolo Gessi.*

Kerri, May 5, 1876.

Knowing the interest which the English people generally take in Central African Exploration, I am induced to lay before the Royal Geographical Society an account of the voyage I have just made round Albert Nyanza. His Excellency Colonel Gordon, Governor-General of Equatorial Africa, kindly entrusted this mission to me, and placed at my disposition two iron boats constructed by Messrs. Samuda Brothers, together with all that was necessary to the accomplishment of my mission.

I had rigged the two boats as cutters, and manned them with 18 sailors and 12 soldiers. I left Dufli on the 7th of March, 1876, and arrived at the mouth of the lake on the 18th of the same month; our slow progress being attributable to the contrary winds, the incessant rains, and the currents. My mission was to explore the part of the river between Dufli and the lake, to visit Magungo, and to go round the lake. Before proceeding to describe my voyage on the lake, it will be useful to give some details regarding the part of the Nile in question, which had never previously been explored.

From Dufli to the lake is 164 miles, and throughout the whole distance the river is navigable, deep, and broad; in certain places exceeding 700 yards. At two-thirds the distance from Dufli there is a large branch which runs in a N.N.W. direction, and probably flows towards Makraka, in the country of Niam Niam. The country is very rich; the natives are clothed in the skins of antelopes or goats; and the products of the soil are varied, consisting of millet, the wheat of the country, sesame, honey, tobacco, bananas, beans,

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* Translated by the Assistant-Secretary of the Society.

&c. Cattle are abundant, and comfort and plenty appear to reign among the people.

We arrived at the entrance to the lake at the time of the equinox, and the stormy weather compelled us to wait. On the 20th of March, allured by the promise of a fine day, I started to traverse the north-eastern corner in the direction of Magungo; but, when we were about two-thirds across, a strong land-breeze suddenly sprung up, and prevented us from reaching the coast. All our efforts were in vain; the wind increased in violence, and we had to run before it, under double-reefed sails, trying all we could to keep the shores in view and discover some convenient anchoring-place. We saw a sandy beach which might have answered our purpose; but it was occupied by a party of disbanded soldiers of Kaba Rega, who had come with the intention of attacking us. Their threatening attitude obliged us to continue our course; but the natives kept pace with us along the beach, hoping that sooner or later our vessels would be driven ashore. After much difficulty, we managed to escape from these troublesome neighbours, and anchored in a harbour having the form of a horse-shoe. The foul weather continued during the night, and at midnight the wind became so strong that one of our boats dragged its anchor, the bottom being of loose sand, and ended by being driven ashore at about three in the morning, and becoming filled with water and sand. The greater part of our provisions was thus destroyed, as well as our instruments. Our position became difficult, for we were still in the neighbourhood of the hostile troops. With the materials that the water had cast on the beach we constructed a small barricade, with only one weak point to be afraid of. Two Dutch pieces, No. 2, loaded with grapeshot, were placed in position, and we then waited for the termination of the storm in order to commence repairing damages. Towards morning the wind calmed down, and with it the heavy sea subsided. Nailing a sail round the boat, we commenced to bale out the water and sand, and, assisted by both boats' crews and the soldiers, we succeeded in raising the vessel and resuming our voyage in the direction of Magungo. On the 30th of March we reached our destination; but the hostility of the natives compelled me to proceed up the Victoria Nile in search of some village belonging to Aufina's Government. Near Murchison Falls I found a Chief subject to the (Egyptian) Government, who undertook to carry my message to Aufina, where the commander of our troops would be found. Ten days afterwards the troops arrived, and I gave them their orders. On the 12th of April I was again *en route.*

Extracts from my Journal.

April 12th.—At 4 A.M. we arrived near the first islets, which lie 5 to 7 miles distant from the shore: they are sand-banks, on which there is some vegetation, and they afford good shelter to vessels against all winds. At the time when I reached them they were full of natives, who had resorted here to escape the pursuit of the troops.

13th.—Continued our route as far as the last of the islets. The mainland of the lake is low, the shores sandy, and the interior rich in vegetation and timber. We passed a cataract, then a second, and after that a third. There was a village, and I was able to obtain of the inhabitants the following information:—The first cataract is called Huima; the second, Wahambia; and the third, Nanza. They proceed from a large river, which is never dry, and which is called Tisa. I have no doubt this is the River Kaiigiri of Sir Samuel Baker. The natives declare that, although they have been very far into the interior of Uganda for ivory, they have never reached the source of this river.

15th and 16th.—Continued our course, and at 8 P.M. experienced a strong wind from the east, which increased in violence towards 10 P.M. We reefed sail, and about 2 A.M. secured our boats in a snug harbour, which I have named Port Schubra. It contained many villages, and I am certain that it is the Vacovia of Sir S. Baker; but the name has disappeared, other tribes having driven out the former occupants. This port is 250 yards wide and 600 or 700 in length. The shores of the mainland form cliffs descending to the water.

17th.—I remained all day in this port, baling the water from our boats, and drying our linen. We had been for thirty-six hours exposed to incessant rain.

18th.—Resumed our voyage. The wind was favourable. After a course of some 40 miles, I noticed in the distance islands and vegetation. The water had changed its colour and become whitish; from the mast-head it had a reddish hue, and, on casting the lead, the depth proved to be only 12 feet, with muddy bottom. I have no longer any doubt that we are near a river. After continuing 10 miles further, we entered the river, and ascending it 7 miles, were stopped by the growth of papyri and other aquatic vegetation. From the heights a large waterfall leaped down, much grander than the three we had already passed. The river came to an end in this *cul de sac.* The natives had fled from the village which we found close at hand; nevertheless, I was unwilling to quit the place without trying every means of obtaining accurate information. After we had been waiting some hours, the sailors called me to look at a hippopotamus which was just emerging from the water to enter the thickets. A shot from one of Reilly's rifles, No. 8, brought it down, the ball having pierced its forehead, and effectually stopped it from taking another step.

Three of the natives slowly approached us, although the report of our gun had created some alarm at the commencement. I told them they might help themselves to some of the hippopotamus meat. They began with a will, and cut slices of the meat with their lances; others followed them, and, in a short time, more than fifty of them had reduced the animal to a skeleton. After giving them *suksuk*, and gaining their confidence to some degree, I was able to obtain the following information, viz., that the waterfall came from waters which accumulate in the mountains, and form a river during the season of the rains, but dry up, together with the river, in the dry season.

They asked me where I was going, and having told them I was going to the end of the lake, they replied, "You are already at the end of the lake: you cannot get beyond the ambatch, for the water is only *so* deep," showing me the height of their knees. I told them I wanted to see the river that there was at the end of the lake. They assured me there was no river at the end of the lake; and when I retorted that there must, at any rate, be a waterfall, they said there was not; there was no river or fall, yonder or elsewhere, at the end of the lake, except the one before us. A storm arose, and we returned on board just in time to get up the anchor and run clear of a floating island, which came towards us with incredible velocity. This country is called Quando, and the inhabitants are suspected of cannibalism.

19*th.*—We cleared out of the river, and endeavoured to force a passage through the ambatch, but all to no purpose, the ambatch-growth being very dense, and the water, as the natives had told me, very shallow. We continued, in this way, to navigate along the ambatch, the boat's keel touching the bottom from time to time. The water everywhere had a black colour, owing to the forests of ambatch, and it was undrinkable; there was no current whatever, and the bottom was sandy. Keeping thus to the border of the ambatch-fields, we crossed the lake from east to west, a distance of 40 miles, without finding any passage. From the mast of the boat I observed that the forest of ambatch extended very far, and that beyond it there succeeded a field or valley of herbs and vegetation which reaches to the foot of the mountains.

We now found ourselves on the opposite shore and wished to obtain information at a village which lay before us; but the inhabitants carried off their property. The Nogaras called together their warriors, and made hostile demonstrations. I waited until they had finished their military evolutions, hoping that some one would then approach; but they were very hostile, and we could not get near them with our boats. It was now dark, and we retired a little from the shore.

20th.—The next day I again approached the shore, but saw none of the natives. The sound of their drum had not ceased all the night. I sent a man up the mast to see if no one was coming to meet us. The man reported that they were close at hand, concealed by hundreds in the bushes. It was an ambuscade. Half an hour afterwards five natives came to tell us that the chief was waiting for us; that he had prepared meat and merissa; and that we were all to land. I thanked them, saying we had no desire to land; but only wanted them to show us the way to the end of the lake. Their reply to all our speeches was, "Come, come to the Chief." I left the place; and, after an hour's sailing, reached another large village. Although the inhabitants here also fled to the hills with their household goods, they showed no hostility, and some of them came so near that our interpreter was able to make himself heard. I asked them to send the Chief to speak with me. In the course of half an hour an old man of some sixty years came and sat down on the beach; and having made him a liberal present of glass beads and copper wire, I put the following questions to him:—

Q. "I want to reach the end of the lake; please show me a place where I can find a passage?" *A.* "You cannot get beyond the ambatch; there is no water."—*Q.* "How much water is there as far as you can reach among the ambatch?" He showed me his pipe, to indicate the depth—about 15 inches.—*Q.* "There is a river entering at the end of the lake, which I wish to see." *A.* "There is not any river at the end, nor anywhere else in this neighbourhood; but there is one yonder," showing us the opposite shore, which we had recently left.—*Q.* "But there is certainly a waterfall?"—*A.* "No, there is no waterfall; but, if you go further on, you will meet with three falls."—*Q.* "Where do these three falls come from?"—*A.* "From a river formed by the waters of the rains."—*Q.* "Is the water permanent?"—*A.* "No; when the

Harif ceases, the river and falls cease also."—*Q.* "What is the name of this river?"—*A.* "I have never heard that it has a name."—*Q.* "What is there at the end of the lake, where the ambatch terminates?"—*A.* "Sand and bushes. The water ends in the middle of the ambatch; there is very little water there."—*Q.* "Do the waters remain here always at the same level, or do they rise during the heavy rains?"—*A.* "They remain almost always the same; if they rise, it is very little or none at all."

All my efforts were without result, and the last information I received agreed perfectly with what I had been told on the eastern side. The stagnant and blackish water, the sandy bottom, the total absence of current, the shallow depth, all proved that there was no river at the end of the lake. From Vacovia to the end of the lake, also on the western side, the mountains descend vertically to the water, and are destitute of large timber, being clothed with bushes only. I can say nothing about the interior, as I was not able to undertake a land journey with so small an escort, nor could I leave the boats without protection. Nothing further being practicable, I prepared for our return, and we directed our prows towards the north.

Favoured by the wind, we passed the three falls which the old Chief had told us of. During the night the wind increased in violence, and at midnight it blew a hurricane. At 3 A.M. our position became critical. Violent gusts of wind succeeded each other from different quarters all round the compass; and the waves surging tumultuously on all sides, we expected every moment to founder. We lightened the fore part by removing every article, even the anchor and cable, and all the men were employed in baling out the water. It was a night of agony. There was not a single harbour or sheltering-place all along the coast, and we were driven 40 miles out of our course. At last the wind became more favourable and towards five o'clock in the evening we came in sight of M'Caroly.

I did not notice any currents during my voyage, except that with strong south-west winds the water drifted towards the north-east, and with north-east winds towards the south-west. I remarked that there was a line on the face of the rocks about 4 inches above the present water-level; but I am not able to say if this line marks the limit of highest water in the lake, the natives having on all sides assured me that the waters neither rose nor fell.

In conclusion, I may remark that those only who visit Albert

Nyanza during the rainy season can form any idea of the immense amount of the rainfall in this region. Any further information that you may require I shall be happy to supply.

I have, &c.,
ROMOLO GESSI,
Attaché to the General Staff of Gordon Pacha.

Length of the Lake, 141 miles; greatest width, 60 miles.

4. *The Khedive's Expedition to the Lake Districts.*

By Colonel C. E. GORDON.

[Communicated by the Rev. E. J. DAVIS.]

Alexandria.

As so much interest has been taken in the different expeditions to the sources of the Nile, I give a summary of what Colonel Gordon's expedition has effected.

Colonel Gordon started from Cairo on the 23rd February, 1874, and reached Gondokoro on the 16th April, 1874. Finding that his government consisted of the three military stations, Gondokoro, Fatiko, and Foweira, that the troops were in want of many things, and in arrears of pay, he determined to return to Khartoum to obtain more troops, and to meet his stores. Having done so, he started with the same on the 8th June, 1875, and arriving at the Sobat junction with the Nile, he sent his staff on, and remained at the Sobat to form a station there, and to supervise the evacuation of two slave establishments on Bahr Zaraffe. Owing to heavy rains and delays, he did not arrive at Gondokoro till September, 1874. It was then seen that Gondokoro was unfitted for a station, owing to want of wood for fuel for the steamers, and from the want of Dhurra, which the natives there did not cultivate. It was decided therefore to evacuate it, and to establish two stations, Lardo and Rageef, one 12 miles below, and the other about the same distance above, Gondokoro. This evacuation was not completed till the 1st January, 1875, when Colonel Gordon descended and made an inspection of the stations, Bohr and the Sobat, returning to Lardo on the 4th March. The remainder of the month of March was spent in the subjugation of Bedden and other hostile Sheikhs near Rageef; and now had to be faced the great difficulty, viz., how to establish a safe communication between the Lake Districts and Lardo.

Taking it roughly at 120 miles, the intervening country was one devoid of supplies, unless taken from the natives by force; in the rainy season the numerous streams were torrents, while in the dry season little water could be obtained. The natives were friendly or hostile, according to your force, but may be generally said to be hostile. A reconnaissance having shown the Nile to be navigable considerably farther south than was supposed, it was determined to establish the line of posts to preserve the communications between the north and south of the province, along the left bank of the Nile, and not to attempt the usual inland road. Keeping to the Nile prevented attacks being made on the stations from more than one side, and secured, at all seasons, a supply of water. Troops were pushed up from Rageef to Bedden Rapids and Kerri, but at Moogie the natives became very hostile, and caused much delay, so that it was not till October, 1875, that the chain of posts was completed from Lardo to Dufli, a station established by Mr. Kemp in September, 1874, nearly opposite Baker's Apuddo. A miserable sort of warfare had to be conducted against several of the tribes with little or no bloodshed, if we except the unfortunate affair in which Mons. Linant lost his life. The river was found navigable as far as Kerri; thence to the Asua it was possible to take up vessels, but difficult, however, from the Asua junction with the Nile. The river for 10 miles was found quite impracticable; thus this 10 miles is the only obstacle to a vessel of 60 to 80 tons ascending from the Mediterranean to the Lake Albert.

By the 1st January, 1876, the whole of the sections of the 50-ft. steamer and two iron life-boats had arrived at Dufli, and their construction commenced, while troops were massed at Foweira for an advance south, towards Victoria Lake.

By the end of April, 1876, the Lake Albert had been circumnavigated by M. Gessi, who found it much of the size it was supposed to be by Captain Speke, with no river of importance entering it; a branch from the Nile, soon after its exit from Lake Albert, flowing to north-west was discovered; where it flows to is not yet known. The stations at Keroto, Mrooli, and Magungo, were formed, and at the end of July the 10-horse-power steamer was completed, and made her first voyage from Dufli to Magungo, at the entrance of Victoria Nile.

There now remains the placing of a steamer on Victoria Nile to ply between Foweira, Mrooli, and Urondogani. From Urondogani, or rather Isamba, to Lake Victoria the Nile is not navigable, so another steamer will have to be placed on Lake Victoria, which will complete the extension of Egyptian territory.

Between Urondogani and Mrooli there is a Lake Masanga, from which a branch flows to the north-west and which may flow into the River Asua or River Sobat.

Mtesa's independence has been respected; and there is every reason to believe Kaba Rega will come to terms and accept the half of his kingdom, Rionga and Aufina occupying the other two quarters of his State.

We may therefore consider the Nile to be known along its whole course, with the exception of the branches flowing north-west from the Nile after its exit from Lake Albert, and that flowing from Lake Masanga, half-way between Mrooli and Urondogani.

The country generally is quiet and the roads secure. The inflow of ivory continues good; and the expenses of the occupation are fully covered by the revenue, which may be put down roughly at 60,000*l.* a year.

Letters from England reach the most southern parts of the Province in little over two months.

The future of the Province will depend much on the amelioration of the route from Cairo to Khartoum, and on the enterprise of private merchants who hitherto have been discouraged from venturing up on account of the insecurity of the routes, which, however, are now safe.

Mr. HYNDMAN rose to thank the Council for giving him, through the kindly intervention of Colonel Yule, an opportunity of placing before the Society a matter which seemed to him to have an important bearing on the future of African exploration—namely, the behaviour of Mr. H. M. Stanley towards the natives. He had no intention of moving a resolution on the subject; all he wished to do was to read a few sentences from Mr. Stanley's own letters, and then to ask the Society, as the leading Geographical Society in the world, whether it ought not to express its opinion upon them. Mr. Hyndman then read some extracts from Mr. Stanley's letters which had appeared in the 'Daily Telegraph' relating to that gentleman's treatment of the natives.

Colonel YULE said he felt constrained to say a few words on this subject, because he had been the means of bringing Mr. Hyndman forward on the present occasion. Whatever technical reasons there had been for stopping the motion which Mr. Hyndman had proposed to bring forward at the previous meeting (and these he by no means disputed), there were far stronger reasons why Mr. Hyndman should not be "shut up," as many members had considered that gentleman to have been. He did not think there were any serious differences of opinion with regard to Mr. Stanley's proceedings, and he had met with no one who had not condemned them. The Society owed Mr. Stanley a great debt for his discovery of Dr. Livingstone; and that, as well as his absence from England, was a reason for not dwelling upon the details of his narrative. Still, they could not do him any very great injustice if they judged of the character of his acts by his own letters. Mr. Hyndman had been very persistent in his conduct of this question, because he was very much in earnest; though his speech this evening had shown that he was anything but a factious person, who wished to get up an agitation in the Society. He (Colonel Yule) did not agree with the proposal to pass a formal resolution. The Society had not sanctioned Mr. Stanley's proceedings by any formal resolution, and therefore he did not see why they should condemn them by such a resolution. He, however, thought utterance should be given in a meeting of the Society to a condemnation of Mr. Stanley's acts; for twelve months ago a meeting of the Society was devoted to the glorification of Mr. Stanley, and what the newspapers called an "ovation" was given to that gentleman. He did not think that on that occasion the Fellows had thoroughly digested the letters; and even Mr. Hyndman said nothing then. Next day, however, he wrote to the 'Pall Mall Gazette' on the subject, and commenced that course of remonstrance, which he had since so consistently followed out. "Ovation," he believed, was etymologically connected with *ovis*, a sheep; and when people got upon lines of excessive glorification, they were very apt to follow one another like a flock of sheep, and not see all the puddles they came across. Taking Mr. Stanley's own narrative, how were the natives to distinguish between such a body of roving foreigners, armed with such desperate weapons, and the slave-gangs that Livingstone died to suppress, except that Mr. Stanley's canoes on the Victoria Nyanza must have seemed to them to have devils on board far more terrible than the Arab slavers? How would the next Speke or Livingstone (if it were possible to look for another Livingstone!) fare upon the Lake? It was just such proceedings of their countrymen or supposed countrymen, that brought those two illustrious men, John Coleridge Patteson and James Goodenough, to a cruel end. He felt sure there would have been a more hearty expression of sympathy with Mr. Hyndman, if it had not been that his words were regarded as an attack upon somebody. But at whom could Mr. Hyndman be supposed to aim a blow? Surely, not at the late President, Sir H. Rawlinson, who was the man of all others whose name shed honour upon the Society, and to whom he (Colonel Yule) owed one of the greatest honours of his life—the gold medal of the Society. It should not be *his* hand, at least, that would be lent to such an attack. At whom, then, was the blow aimed? It must be at the Society as a whole, and by them all it ought to be answered. They had all shared in giving Mr. Stanley an ovation; let them all share in expressing condemnation of his acts, as narrated in his last letters.

Sir H. Rawlinson said he simply rose to ask the meeting to consider what was the use of raising this question. The Society was not established for the discussion of such subjects, which did not involve any principles of practical geography. If Mr. Stanley had been one of the Society's agents, he could quite understand any Fellow calling upon them to denounce him; but Mr. Stanley was not a member of the Society; he was not even an Englishman. His connection with them simply was that he had received their gold medal for services performed, and no one could question that those services were great, and that the Society was quite justified in according him the medal. His own position with regard to this question was rather remarkable. Two years ago he was criticised in the columns of 'The Times' for not giving Mr. Stanley sufficient credit; but now he was supposed to be too much in his favour. The real fact was that he did not look at Mr. Stanley's moral qualities or personal character, but solely upon his geographical services, and when he succoured Livingstone he certainly was entitled to reward. Last year, when the news of the circumnavigation of the Victoria Nyanza arrived, he (Sir Henry) was also glad to help in giving Mr. Stanley an "ovation." But giving "ovations" was not the province of the Society; their business was the furtherance of geographical research, and any person who contributed to that was entitled to their warm approbation. He had no hesitation in saying that he did not approve of Mr. Stanley's deeds, as recorded by himself; but that was no reason why the Society, in its collective capacity, should pass any vote of censure or pronounce any general condemnation.

Sir **Bartle Frere** thought it was as well now to take the course generally known as reverting to the previous question, and rest content with what had already been said. Mr. Stanley was at the present moment engaged in exploration, and therefore should not be judged harshly. They should recollect that they had only a hasty letter, written in the midst of difficulties; and without for one moment saying that Mr. Hyndman had done wrong in bringing forward the subject, he thought they might pass to the previous question. That question was the exploration of Africa. The King of the Belgians had proposed, at the International Congress, at Brussels, a united effort by the nations of Europe to open up Africa to civilisation. His suggestion was that each country should determine on a particular route to the interior, and devote its energies to opening it up. It was well known how costly it was to carry on geographical explorations, and nothing but the great expense deterred commercial men from going to clothe those tribes who, we had just been told, were either entirely naked, or simply wore skins of beasts and the bark of trees. There were rich, well-watered countries in Africa; and a continued repetition of such expeditions as that of Cameron would open to the producing countries of Europe a vast amount of commerce. He had had the pleasure of explaining the King of the Belgians' plan to the people of Glasgow, who had a deep feeling of pride in their countrymen—Mungo Park, Bruce, and Livingstone; and many of them volunteered to undertake the support of the scheme. Mr. James Young and Mr. Wright were, with Mr. Stevenson and Mr. Mackinnon, foremost in the work; and he hoped that when the President laid before the public the details of the plan, London would make haste and work very hard if they did not wish to be beaten by Glasgow. This scheme would not be antagonistic to any of the work that the Society had hitherto undertaken in Africa. The International Society would be a sort of Executive Exploration Society, undertaking to do, once and for ever, what was now separately done by individual effort. The Glasgow people had appropriated to themselves the great route from the eastern coast to the north of the Lake Nyassa. Upon that lake, which Livingstone pointed out as the centre of the slave-trade in that part of the world, two Scotch missions had already established themselves. They had a steam launch upon its waters; and they were resolved, if possible, to carry on the line of exploration to Lake Tanganyika. Cameron had pointed out that, from Alexandria to the mouth of the Zambesi, there were only a few hundred miles separating the navigable rivers and lakes, and that with short portages, such as might easily be established, it was quite within the power of Englishmen of the present day to have a continuous communication from the Zambesi to the mouth of the Nile. He trusted that the King of the Belgians' scheme would not be allowed to drop through by the Royal Geographical Society.

Mr. E. **Hutchinson** (Secretary of the Church Missionary Society) said that he had long felt convinced of the importance of improving the means of access to the interior in order to suppress the Slave-trade and develope the resources of the country, and that it would be desirable to select for improvement the line between the coast near Zanzibar and the great centres Unyanyembe and Ujiji. Those who had read the works of Speke, Grant and Stanley would remember the importance which those travellers attached to the River Wami as a highway to the interior, and accordingly, when Sir Bartle Frere was in Zanzibar, the Church Missionary Society wrote to him asking him to have that river surveyed, and Sir Bartle Frere had a portion of it surveyed. Since then the Missionary Society had sent out a steam launch, and the river had been explored, but he was sorry to say that their anticipations had not been realised, for it was found to be thoroughly unsuited to anything like a water-way; for, after a journey of 65 miles, the exploring party were only 15 miles from the coast. The river Kingani had been tried with a similar result, and the idea of water communication was therefore abandoned. A station had, however, been established at Mpwapwa, on the first range of hills about 200 miles from the coast, and information had since been obtained which encourages the belief that a practicable road might be made between Mpwapwa and Saadani or Bagamoyo with no great difficulty. The London Missionary Society were working side by side with the Church Missionary Society in endeavouring to open up the interior, and the land had been apportioned out between the two Societies, the Church Missionary Society taking the Victoria and Albert Nyanza, and the London Missionary Society taking Tanganyika as their field. While the Church Missionary Society were trying their plan of water communication, the London Missionary Society were trying the old-fashioned bullock-waggon, and Mr. Roger Price, the agent of the latter Society, had discovered that the dreaded tsetse-fly was not to be found in a route running from Saadani to the north of the Wami up to the highlands of Mpwapwa. The road was not quite so smooth as it might be, but Mr. Price had furnished full information as to its character, and the Church Missionary Society had sent all the details out to their agents at Mpwapwa, with instructions to do all that could be done to make the route practicable for bullock-waggons. One part, therefore, of what the King of the Belgians had been contemplating the Missionary Societies were doing, and a practicable road was about being made to Mpwapwa. Once there the waggons would come upon the great rolling plateau which runs right away to Unyanyembe. On that plateau the Victoria Nyanza was situated, and Colonel Grant had said that, if the waggons were once placed on the plateau, he did not see why they should not get along as easily as at the Cape of Good Hope. The Church Missionary Society had asked the Government to aid the Sultan of Zanzibar, who was perfectly honest and sincere in his efforts to help them, to protect the road when made. Such a road would cut the neck of the Slave-trade. With regard to the plan adopted by the Scotch Committee of extending a road from the north of Lake Nyassa to Lake Tanganyika, he was inclined to fear, from the information furnished by Livingstone, and also from Jacob Wainwright's journal of his march with Livingstone's body from Bangweolo, that access between Nyassa and Tanganyika would not be a very easy matter. He sympathised with what had been said as to the result of Mr. Stanley's operations on the Victoria Nyanza; but he did not think the details which had been referred to by Col. Yule were before the Fellows when they gave the "ovation" to Mr. Stanley. The moment the Church Missionary Society heard of them, they telegraphed to Dr. Kirk, begging him to tell their agents that Stanley had met with the most determined hostility on the south of the lake; and they had been glad to learn that that information had reached the party, and would probably influence them to a certain extent in the route they selected. If everything went well, it was hoped that by next June there would be a steam launch upon Victoria Nyanza.

Mr. J. Fowler, c.e., said he had had no personal experience of any part of Equatorial Africa south of Wady Halfa. His professional duties in Upper Egypt and Nubia, and in places further south and west, had been to improve the transport communication in the Nile valley, partly by the construction of a short railway at Assouan, to overcome the obstruction of the First Cataract, and partly by a cheap railway south of Wady Halfa, where the navigation of the river was impossible. He had, however, under the direction of His Highness the Khedive, made careful surveys, with levels, into Darfur, as far as its capital, El Facher, and through Kordofan to Khartoum by various routes. So soon as the details were completed, he would have the greatest possible pleasure in placing the information he had obtained at the disposal of the Society.

Sir H. **Rawlinson** observed that the discussion had very much departed from the actual subject of the Papers, which was Colonel Gordon's proceedings on the Upper Nile. Colonel Gordon had rendered great assistance to African exploration. The information which had been obtained from him and his subordinates was of the utmost value. If the arm of the Nile which had been discovered striking out from the well-known course of the river to the north-west proved to be navigable, it would be of great importance to the future development of the interior of the Continent. In the same way, if the arm leaving Lake Ibrahim really joined the Sobat, it would avoid the impediments of the Karuma Rapids and the Murchison Falls. Colonel Gordon was now returning to England. He had done his work well, and had suffered severely in health and spirits. At the time he (Sir H. Rawlinson) last heard from him, Signor Gessi was the only European still remaining with him—all the rest having died or been invalided; so that he was left with only Egyptian officers, on whom, of course, he could not depend as upon European officers. Although ovations were strictly not part of the duties of the Society, they must sometimes fall into temptations of that kind, and if any man was ever entitled to an ovation, Colonel Gordon would be, on his return. It should be remembered that this was "Chinese Gordon," and no one could be more thoroughly conscientious, more unselfish, and more energetic in his work.

The **President** said it was quite true, as Sir H. Rawlinson had remarked, that the meeting had not specially directed their attention to the interesting geographical questions dealt with in the Papers which had been read, and to the great service which the Khedive and Colonel Gordon had rendered, not only to the cause of Geography but to the cause of humanity in general, in opening up a communication from the Mediterranean to the Albert Nyanza and the Victoria Nyanza. He cordially sympathised with what Sir H. Rawlinson had said about Colonel Gordon. He had the pleasure of knowing him in China, where he proved himself a Christian soldier, a brave general, and a most able and skilful man, who could combine and form into an army the roughest and rawest of Chinese recruits, and lead them to victory. He did not think there was any exaggeration in saying he saved the Chinese Empire, or, at all events, the reigning dynasty there, for without his great knowledge and skill and influence over men, it would not have been possible for China to have emerged from the state of chaos and revolution into which it was plunged by the Taipings. Still, when Colonel Yule thought there was a disposition to "shut up" people who had any legitimate feeling to give expression to, he was not sorry that the discussion had taken the turn it had, and in consequence had somewhat passed over the great services which Colonel Gordon had performed in Africa. It could not now be said that there was any desire on the part of the Council to "shut up" any legitimate expression of opinion on the part of the Fellows. He did not believe that there were two shades of feeling with regard to the conflicts of Mr. Stanley with the natives of Africa, and he thought Lord Derby had expressed the feeling of the whole nation when he said that Mr. Stanley's later letters were read with great regret, and that they created a most painful impression throughout the country. But it should be remembered at the same time that he had rendered great service in finding Livingstone,—that he was one of the boldest and most successful of explorers, and that he was now travelling in hourly peril, carrying his life in his hand, amid hostile tribes full of cruelty and treachery, and even if they only intended to rob him, yet robbery in those parts meant depriving him of the means of existence or of return to the coast. He was assailed with overwhelming numbers in the first conflict that he had described, and if he were now present he might probably be able to defend himself against the charge of having caused greater loss of life than was absolutely necessary for his preservation, and to give better reasons for what he had done than appeared in the hurried and sensational letters which had reached England. The Society was bound to remember his past services, and that he was now travelling, not for gain, but simply to win the reputation of being one of the most successful travellers who had ever entered the interior of Africa. The Society had no control over him; he was not even an Englishman, though he carried the English flag (and that was a subject of regret to many), and therefore the Society had no right collectively to censure him. No doubt there was a unanimous feeling with regard to his proceedings, and all condemned in the very strongest way the circumstances, so far as they were known, of apparently ruthless slaughter and violence, which he had described in the second attack on the island of Bambiré, but they could not do so as a Society. Sir Bartle Frere had drawn attention to the present crisis in African Exploration. So much had been done of late years that it seemed as if the two oceans, east and west, and the Mediterranean, were about to be united, and a line of communication formed which would open up Central Africa to commerce and civilisation, and put an end to the most atrocious slave-trade that ever existed. The International Society would not sanction, either directly or remotely, any unnecessary violence or bloodshed; but even in civilised countries, if brigands or pirates attempted to rob and murder, a man was allowed, by the law of self-preservation, to defend himself by every means in his power, and in Africa, where there was no law, force must be met by force. He did not think it possible to carry out the most philanthropic measures there without occasional hostile collisions with the natives, and in such cases where there was no law such force as was necessary in self-defence must be exercised. Sir Bartle Frere had said all that it was necessary to say as to the great and disinterested aims of the International Congress held at Brussels, and he hoped that the Royal Geographical Society, while remaining uncommitted to any line of action, would take the most cordial interest in all proceedings which had for their object the opening up of Africa to commerce, the suppression of a most flagitious slave-trade, and the spread of the truths of the Gospel and of civilisation throughout Africa.

The following is the "Summary" referred to by the President, in his opening remarks, p. 47.

Summary of Geographical and Scientific Results accomplished by Expeditions made by the Government of the Khedive of Egypt during the three years 1874–5–6.

War Office.
Bureau of the General Staff, Cairo.
16th October, 1876.

1st. Accurate reconnaissance of the White Nile, from Gondokoro to Lake Albert.

(Gordon, assisted by Watson, Chippendall, and Gessi.*)

2nd. Reconnaissance of the White Nile between Khartum and Gondokoro, with greater exactitude than had ever before been accomplished; with the determination of five positions by means of astronomical observations.

(Watson and Chippendall, under the orders of Colonel Gordon.†)

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* 'Proceedings' R. G. S., vol. xix., pp. 324, 455; vol. xx. pp. 12, 67, 443, 470; vol. xxi. pp. 15, 48 et seq.

† To be published in the 'Journal' R. G. S., with Map, vol. xlvi.

3rd. Observations of the Planet Venus, December, 1874, by Watson and Chippendall, under the orders of Colonel Gordon, at Rageef, near Gondokoro.

4th. Reconnaissance of Lake Albert, 1876, by Gessi, under the orders of General Gordon.*

5th. Establishment of steam-navigation on Lake Albert, by General Gordon.

6th. Verification of the course of the Nile between Lake Victoria and M'rooli, and the discovery of Lake Ibrahim, by Lieutenant-Colonel Long, under the orders of General Gordon.†

7th. Verification of the course of the Nile between the Falls of Karuma and Lake Albert, by Linant, Gessi, and Piaggia, under the orders of General Gordon.‡

8th. Discovery of the branch flowing from Lake Ibrahim, in a northerly direction, by Piaggia, under the orders of General Gordon.

9th. Discovery of the branch flowing from the Nile, near Lake Albert, towards the north-west, by Gessi, under the orders of General Gordon.§

10th. The accurate reconnaissance of the Nile between Foweira and M'rooli, by General Gordon.

11th. Reconnaissance of the country between the White Nile, near Gondokoro and Makraka, in the Niam-Niam country, by Colonel Long (assisted by Marno), under the orders of General Gordon.

12th. Reconnaissance and completion of the Map of the route between Debbé and Matovi, and between Debbé and Obeiyad, by Colonel Colston, assisted by five officers of the Egyptian Staff.

Report of the northern portion of the Province of Kordofan—Colonel Colston.

13th. General reconnaissance of the Province of Kordofan, and completion of the Map to the 12th degree of north latitude, by Major Prout, assisted by five officers of the Egyptian Staff. Lines of reconnaissance traversed about 6000 kilomètres, and 17 positions determined astronomically. General Report upon the said Province by Major Prout.

14th. Botanical reconnaissance (with large collection of plants) of the Province of Kordofan, by Dr. Pfund, under the orders of Colonel Colston and Major Prout.

15th. Botanical reconnaissance (with collection of plants) of the central portion of the Province of Darfur, by Dr. Pfund, under the orders of Colonel Purdy.

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* 'Proceedings' R. G. S., vol. xxi. p. 50.

† Ib., vol. xx. p. 107.

‡ Ib., vol. xxi. p. 49.

§ Ib., vol. xxi. p. 50.

16th. Reconnaissance of the route between Dongola, upon the Nile, and El Facher, the capital of Darfur, by Colonel Purdy, assisted by Lieutenant-Colonel Mason and five other officers of the Egyptian Staff.

17th. General reconnaissance of the entire country of Darfur, and a portion of the Dar Fertit, as far as Hofrat el Nahass and Shekka to the south, as far as Gebel Medob to the north, and as far as the frontier of Wadai to the west; with the completion of the Map and general Report upon the country. By Colonel Purdy, assisted by Lieutenant-Colonel Mason, Major Prout, and nine other officers of the Egyptian Staff. Distance traversed, over 6500 kilomètres. Twenty-two positions determined astronomically.*

18th. Geological and mineralogical reconnaissance of the country between Rudesiëh and Kinneh, upon the Nile, and the Red Sea, near Cosire; with a Geological Map and profile, and Report. By Mr. Mitchell, assisted by an officer of the Staff, and Emiliano; with large collection of specimens.

19th. Topographical and geological reconnaissance of the country to the south-west of Zeylah and near Tajurra, by Mr. Mitchell, assisted by an officer of the Staff, and Emiliano. Preparation of the Map. Collection of geological specimens.

20th. Reconnaissance and completion of the Map between Zeylah and Harrar, Map of the city of Harrar and neighbouring country, by Major Mocktar, of the Staff, assisted by Adjutant-Major Fouzy, of the Staff attached to the Expedition of Raouf Pacha.

21st. Topographical reconnaissance of the country between the coast of the Red Sea, near Massowah, and the Abyssinian plateau; with the completion of the Map. By Colonels Lockett and Field-Lieutenant-Colonels Derrick and Balig, Majors Dulier, Dennison, and Dürholz, Captain Irgem, and several other officers of the Egyptian Staff.*

22nd. Geological reconnaissance of the country between Massowah and the Abyssinian plateau; with collections of specimens. By Mr. Mitchell, assisted by Emiliano.

23rd. Reconnaissance and survey of the country between Berberah and Gebel Dobar; with completion of the Map. By Captain Abd-el-Rarock Hasmy and other officers of the Egyptian Staff.

24th. Reconnaissance and sounding, with completion of Map, of the Ports of Kismaya and Durnford, upon the coast of the Indian Ocean, by Colonel Ward, assisted by Captain Sidky and other Staff officers.

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* A copy of the Observations is deposited in the Library of the Royal Geographical Society.

25th. Reconnaissance between Tajurra and Aussa, by the Staff-Lieutenant Mohammed Izzat, under the orders of Munzinger Pacha.

26th. Reconnaissance of the town and completion of the Map between Siout (by the Desert) and Aïn-el-Aghiëh, by Major Dürholz, assisted by an officer of the Egyptian Staff.

27th. Barometrical and thermometrical register taken by officers in the Province of the Equator, Kordofan, Darfur, and during all the Expedition.

ADDITIONAL NOTICES.

(Printed by order of Council.)

1. *Address delivered on the opening of the Geographical Section, at the Glasgow Meeting of the British Association, September 7th,* 1876. By Captain F. J. O. Evans, C.B., F.R.S., Hydrographer to the Admiralty; President of the Section.

Two events, notable in the annals of Geographical Science have to be recorded since the last meeting of the British Association; and these events as bearing materially on the advancement of our knowledge of geography are deserving the special commendation of this Section. I refer to the successful issue of Cameron's land journey across the tropical regions of Southern Africa and to the successful completion of the sea voyage of the *Challenger;* a voyage which in its scope included the circumnavigation of the globe, the traversing the several oceans between the 50th parallel of North latitude and the Antarctic circle, and the exploration throughout, by the medium of the sounding-line and dredge, of the contour features, the formation, and the animal life of the great oceanic bed.

The general results of the notable African land journey have already, through our Parent Society in London, been brought largely under public review; and at our present meeting many details of interest will be placed before you by the intrepid traveller himself. The courage, perseverance and patient attention to the records of this long travel have been dwelt on by our highest geographical authorities, and so far it might appear superfluous to join in praise from this chair; nevertheless, it is to that part of the proceedings of Cameron, the unvarying attention and care he bestowed on instrumental observations, in order to give those proceedings a secure scientific basis, to which I would direct your attention as being of a high order of merit.

With this example before us, remembering the country and climate in which such unremitting labours were carried out; distinction to the future explorer cannot rest on the mere rendering of estimated topographical details, but can alone be fully merited when those details are verified by instrumental observations of an order sufficient to place numerically before geographers the physical features and characteristics of the explored region.

Turning now from the results of the land journey of Cameron to those of the sea voyage of the *Challenger*, we are again reminded of the value of repeated and methodically arranged instrumental observations in geographical research. With our present knowledge of the sea-board regions of the globe, little remains, except in Polar areas, for the navigator to do in the field of discovery, or even of exploration, otherwise than in those details rendered necessary by the requirements of trade or special industries. It is to the development of the scientific features of geography that the attention of voyagers requires to be now mainly directed; and in this there is an illimitable field. The great advance in this direction resulting from the two leading events of the past year, to which I have referred, foreshadows geographical research of the future.

Communications of special value from some of those voyagers whose good fortune it was to leave and return to their native land in the ship *Challenger* will doubtless be made to this and other Sections.

I trust, nevertheless, as one officially interested in the Expedition from its inception, and as having in early days been engaged in kindred work, and also, as I hope, without being considered to have trespassed on the scientific territories of these gentlemen—ground indeed so well earned—this Meeting will view with indulgence my having selected as the leading theme of my address to it, a review of that branch of our science now commonly known as the "Physical Geography of the Sea;" combined with such suggestive matter as has presented itself to me whilst engaged in following up the proceedings of this remarkable voyage.

It has been well observed that "contact with the ocean has unquestionably exercised a beneficial influence on the cultivation of the intellect and formation of the character of many nations, on the multiplication of those bonds which should unite the whole human race, on the first knowledge of the true form of the earth and on the pursuit of astronomy and of all the mathematical and physical sciences." The subject is thus not an ignoble one, and further, it appears to me appropriate: assembled as we are in the commercial metropolis of Scotland, from among whose citizens some of the most valuable scientific investigations bearing on the art of navigation have proceeded.

As a prefatory remark, I would observe that the distinctive appellation "Physical Geography of the Sea" is due to the accomplished geographer Humboldt; it is somewhat indefinite though comprehensive, and implies that branches of science not strictly pertaining to geography, as commonly understood, are invaded; but this intrusion or overlapping of scientific boundaries is inevitable with the expansion of knowledge: and it is difficult to see how the term can be wisely amended, or how the several included branches of physics can be separated from pure geographical science.

We are indebted in our generation to the genius and untiring energy of Maury, aided originally by the liberal support of his Government, for placing before us, in the twofold interests of science and commerce, an abundant store of observed facts in this field; accompanied too by those broad generalisations which, written with a ready pen and the fervour of an enthusiast, gifted with a poetic temperament, have charmed so many readers, and in their practical bearings have undoubtedly advanced navigation in practice.

In our admiration, however, of modern progress, we must not in justice pass by without recognition the labours of earlier workers in the same field. So early as the middle of the seventeenth century we find in Holland, Barnard Vanerius describing with commendable accuracy the direction of the greater currents of the Atlantic Ocean and their dependence on prevailing winds; the unequal saltness of the sea, the diversity of temperature, as the causes of the direction of the winds, and also speculating on the depths of the sea. Vanerius's geographical writings were highly appreciated by Newton, and editions were prepared at Cambridge under the supervision of that great man in 1672 and 1681.

To Dampier the seaman and Halley the philosopher we owe graphic descriptions of the trade-winds as derived from personal experience; while the investigation by Hadley of their causes, and the conclusions he arrived at, that they were due to the combined effects of the diurnal revolution of the earth on its axis, and the unequal distribution of heat over different parts of the earth's surface, in substance still remains unchallenged.

To Rennell we owe a masterly investigation of the currents of the Atlantic Ocean—an investigation which, for precision and a thorough conception of the conditions affecting the subject, will long serve as a model for imitation. His period covered some thirty or forty years during the end of the last and the beginning of the present century. At that epoch, chronometers—though very efficient—had scarcely passed the stage of trial, but had nevertheless commended themselves to the first navigators of the day; whose aim it was to narrowly watch and test this, to them, marvellous acquisition. Rennell thus commanded nautical observations of a high order of merit, these he individually verified, both for determining the ship's position absolutely and relatively to the course pursued; and our knowledge of surface-currents was established on the secure basis of differential results obtained at short intervals such as a day or parts of a day, instead of the previous rude estimation from a ship's reckoning extending over a whole voyage, or its greater part.

At a later date we have, by Redfield, Reed, Thom, and others, solidly practical investigations of the gyratory, and at the same time bodily, progressive movements of those fierce and violent storms which, generated in tropical zones, traverse extensive districts of the ocean, not unfrequently devastating the narrow belt of land comprised in their track; and on the sea baffling all the care and skill of the seaman to preserve his ship scatheless; while the clear and elegant exposition by Dove of their law, and its application as one common general principle to the ordinary movements of the atmosphere, must commend itself as one of the achievements of modern science.

While, for the moment, in the aërial regions, we must not forget the industry and scientific penetration of the present excellent Secretary of the Scottish Meteorological Society. His more recent development of the several areas of barometric pressure, both oceanic and continental, bids fair to amend and enlarge our conceptions of the circulation of both the aërial and liquid coverings of our planet.

Looking then from our immediate stand-point on the extent of our knowledge, as confirmed by observational facts of the several branches of physics pertaining to the geography of the sea, just rapidly reviewed; we find that, resulting from the methodical gathering up of "ocean statistics" by our own and other maritime nations, in the manner shadowed forth by Maury and stamped by the Brussels Conference of 1853, we are in possession of a goodly array of broad but nevertheless sound results. The average seasonal limits of the trade-winds and monsoons, with the areas traversed by circular storms are known; also the general linear direction and varying rates of motion of the several ocean currents and streams; together with the diffused values of air and sea-surface temperatures, the areas of uniform barometric pressure, and the prevalent winds, over the navigable parts of the globe.

Thus far the practical advantages that have accrued to the art of navigation,—and so directly aiding commerce—by the gradual diffusion of this knowledge through the medium of graphical rendering on charts and concise textual descriptions cannot be over-rated—still much is wanting in fulness and precision of detail, especially in those distant but limited regions more recently opened out by expanding trade. Science views, too, with increasing interest these advances in our knowledge of ocean physics, as bearing materially on the grand economy of nature; essays, brilliant and almost exhaustive on some of its subjects, have been given to us by eminent men of our own day; but here one is reminded, by the diversity in the rendering of facts, how much remains to be done in their correlation, and what an extensive and still expanding field is before us.

The dawning efforts of science to pass beyond the immediate practical requirements of the navigator are worthy of note. We find—from an admirable paper "On the Temperatures of the Sea at different Depths," by Mr. Prestwich, just published in the Philosophical Transactions—that in the middle of last century the subject of deep-sea temperatures first began to attract attention, and thermometers for the purpose were devised; but it was not till the early part of the present century that the curiosity of seamen appears to have been generally awakened to know more of the ocean than could be gleaned on its surface. John Ross, when in the Arctic seas in 1818, caught glimpses of animal life at the depth of 6000 feet; other navigators succeeded in obtaining the temperature of successive layers of water to depths exceeding 6000 feet; but, so far as I can ascertain, James Ross was, in 1840, the first to record beyond doubt that bottom had been reached, "deeper than did ever plummet sound," at 16,060 feet, westward of the Cape of Good Hope.

The impetus to deep-sea exploration was, however, given by the demand for electrical telegraphic communication between countries severed by the ocean or by impracticable land-routes, and the past twenty years marks its steady growth. Appliances for reaching the bottom with celerity, for bringing up its formation, for registering its thermal condition *in situ*, have steadily improved, and thus the several oceans were examined both over present and prospective telegraph routes. Science, aroused by the consideration that vast fields for biological research were opening up—as proved by the returns, prolific with living and dead animal matter, rendered by the comparatively puny appliances originally used for bringing up the sea-bottom—invoked, as beyond the reach of private enterprise, the aid of Government. Wisely, earnestly and munificently, was the appeal responded to, and thus the *Challenger* Expedition has become the culminating effort of our own day.

We have now reached, in all probability, a new starting-point in reference to many of our conceptions of the physics of the globe, and our own special branch may not be the least affected. There is opened up to us, for example, as fair a general knowledge of the depression of the bed of large oceanic areas below the sea-level, as of the elevation of the lands of adjacent continents above that universal zero line. We learn for the first time by the *Challenger's* results—ably supplemented as they have recently been by the action of the U.S. Government in the Pacific, and by an admirable series of soundings made in the exploratory German ship-of-war *Gazelle*—that the unbroken range of ocean in the southern hemisphere is much shallower than the Northern seas, that it has no features approaching in character those grand abyssal depths of 27,000 and 23,500 feet found respectively in the North Pacific and North Atlantic Oceans, as the greatest reliable depths recorded do not exceed 17,000 or 17,500 feet.

The general surface of the sea-bed presents in general to the eye, when graphically rendered on charts by contour lines of equal soundings, extensive plateaux varied with the gentlest of undulations. There is diversity of feature in the western Pacific Ocean where, in the large area occupied by the many groups of coral islands, their intervening seas are cut up into deep basins or hollows some 15,000 or 20,000 feet deep. In the Northern Oceans one is struck with the fact that the profounder depths in the Pacific occupy a relative place in that ocean with those found in the Atlantic; both abyssal areas have this, too, in common,—the maximum depths are near the land, the sea-surface temperature has the maximum degree of heat in either ocean, and two of the most remarkable ocean streams—Florida Gulf and Japan—partially encompass them.

In the Atlantic Ocean, from a high southern latitude, a broad channel, with not less than some 12,000 to 15,000 feet, can be traced, as extending nearly to the entrance of Davis Strait: a dividing undulating ridge of far less depression, on which stand the islands of Tristan d'Acunha, St. Helena, and Ascension, separates this, which may be named the western channel, from a similar one running parallel to the South African Continent, and which extends to the parallel of the British Islands. It is possible that certain tidal, and, indeed, climatic conditions peculiar to the shores of the North Atlantic may be traced to this bottom conformation, which carries its deep, canal-like character into Davis Strait, and between Greenland, Iceland, and Spitzbergen, certainly to the 80th parallel.

There is, however, one great feature common to all oceans, and which may have some significance in the consideration of ocean circulation, and as affecting the genesis and translation of the great tidal wave and other tidal phenomena, of which we know so little; namely, that the fringe of the seaboard of the great continents and islands, from the depth of a few hundred feet below the sea-level, is, as a rule, abruptly precipitous to depths of 10,000 and 12,000 feet. This grand escarpment is typically illustrated at the entrance of the British Channel, where the distance between a depth of 600 feet and 12,000 feet is in places only 10 miles. Imagination can scarcely realise the stupendous marginal features of this common surface depression.

Vast in extent as are these depressed regions—for we must recollect that they occupy an area three times greater than the dry land of the globe, and that a temperature just above the freezing-point of Fahrenheit prevails in the dense liquid layers covering them—life is sustained even in the most depressed and coldest parts; while in those areas equivalent in depression below the sea-level to that of European Alpine regions above it, animal life abundantly prevails: structural forms complicated in arrangement, elegant in appearance, and often lively in colour, clothe extensive districts; other regions apparently form the sepulchral resting-place of organisms which, when living, existed near the surface; their skeletons, as it has been graphically put, thus, "raining down in one continuous shower through the intervening miles of sea water." Geological formations, stamped with the permanency of ages, common to us denizens of the dry land, appear, too, in these regions, to be in course of evolution; forces involving the formation of mineral concretions on a grand scale are at work; life is abundant everywhere in the surface and sub-surface waters of the oceans; in fine, life and death, reproduction and decay, are active, in whatever depths have been attained.

As a question of surpassing interest in the great scheme of nature, the economy of ocean circulation, affecting as it does the climatic conditions of countries, has of late attracted attention. The general facts of this circulation in relation to climate have been thus tersely summarised: "Cold climates follow polar waters towards the equator; warm climates follow warm equatorial streams towards the poles." We can all appreciate the geniality of our own climate, especially on the western shores of the kingdom, as compared with the Arctic climate of the shores of Labrador, situated on the same parallels of latitude; or, indeed, with the rigorous winter climate of the adjacent North-American seaboard, even ten degrees farther to the south. These, and kindred features in other parts of the globe, have led to the summarised generalisation I have just referred to, but the *rationale* of these movements of the waters is by no means assured to us.

That ocean currents were due primarily to the trade and other prevailing winds, was the received opinion from the earliest investigation made by navigators of the constant surface-movement of the sea. Rennell's views are thus clearly stated:—"The winds are to be regarded as the prime movers of the currents of the ocean, and of this agency the *trade-winds* and *monsoons* have by far the greatest share, not only in operating on the *larger half* of the whole extent of the circumambient ocean, but as possessing greater power, by their constancy and elevation, to generate and perpetuate currents; . . . . next to these, in degrees, are the *most prevalent* winds, such as the westerly wind beyond, or to the north and south of, the region of trade winds."

Maury, as far as I am aware, was the first to record his dissent from these generally received views of surface currents being due to the impulse of the winds, and assigned to differences of specific gravity, combined with the earth's rotation on its axis, the movement of the Gulf Stream, and other well-defined ocean currents.

A writer of the present time, gifted with high inductive reasoning powers and with observed facts before him in wide extension of those investigated by Rennell, regards the various ocean currents as members of one grand system of circulation; not produced by the trade-winds alone, nor by the prevailing winds proper alone, but by the continued action of all the prevailing winds of the globe regarded as one system of circulation; and that without exception he finds the direction of the main currents of the globe to agree exactly with the direction of the prevailing winds.

Another writer of the present day, distinguished for intellectual power, and who personally has devoted much time in the acquisition of exact physical facts bearing on the question, both in the ocean near our own shores and in the Mediterranean Sea, without denying the agency of the winds, so far as surface-drifts are concerned, considers that general ocean circulation is dependent on thermal agency alone; resulting in the movement of a deep stratum of polar waters to the equator, and the movement of an upper stratum from the equator towards the poles; the "disturbance of hydrostatic equilibrium" being produced by the increase of density occasioned by polar cold and the reduction of density occasioned by equatorial heat; and that polar cold rather than equatorial heat is the *primum mobile* of the circulation. Analogous views had also been entertained by Continental physicists from sea-temperature results obtained in Russian and French voyages of research in the early part of this century.

We have here presented to us two distinct conceptions of ocean circulation —the one to a great extent confined to the surface, and horizontal in its movements, the other vertical, extending from the ocean surface to its bed, and involving, as a consequence, "that every drop of water will thus (except in confined seas) be brought up from its greatest depths to the surface."

With these several hypotheses before us, it may be fairly considered that the problem of "ocean circulation" is still unsolved. Possibly, too, the real solution may require the consideration of physical causes beyond those which have been hitherto accepted. In attempting the solution, it appears to me impossible to deny that the agency of the winds is most active in bringing about great movements on the surface waters: the effects of the opposite monsoons in the India and China seas furnishing corroborative proof. Again, the remarkable thermal condition of the lower stratum of the water in enclosed seas, as the Mediterranean, and in those basin-like areas of the Western Pacific cut off by encircling submarine ridges from the sources of polar supplies, combined with the equally remarkable conditions of cold water from a polar source flowing side by side or interlacing with warm water from equatorial regions—as in the action of the Labrador and Gulf Streams—points to the hypothesis of a vertical circulation as also commanding respect.

The time may be considered, however, to have now arrived for gathering up the many threads of information at our disposal; and by fresh combinations to enlarge at least our conceptions, even if we fail in satisfying all the conditions of solution. To this task I will briefly address myself.

A grand feature in terrestrial physics, and one which, I apprehend, bears directly on the subject before us, is that producing ice movement in the Antarctic seas. We know from the experience gained in ships—which, to shorten the passages to and from this country, Australia and New Zealand, have followed the great circle route, and thus attained high southern latitudes—that vast tracts of ice from time to time become disrupted from the fringe of southern lands: reliable accounts have reached us of vessels frequently running down several degrees of longitude, sadly hampered by meeting islands of ice; and especially of one ship being constantly surrounded with icebergs in the corresponding latitudes to those of London and Liverpool, extending nearly the whole distance between the meridians of New Zealand and Cape Horn: indeed, accumulated records point to the conclusion that on the whole circumference of the globe south of the 50th parallel, icebergs, scattered more or less, may be constantly fallen in with during the southern summer.

The Antarctic voyages of D'Urville, Wilkes, and James Ross assure us of the origin and character of these ice masses which dot the Southern seas. Each of these voyagers were opposed in their progress southward—D'Urville and Wilkes on the 55th parallel, Ross on the 77th, by barrier cliffs of ice. Ross traced this barrier 250 miles in one unbroken line; he describes it as one continuous perpendicular wall of ice, 200 to 100 feet high above the sea, with an unvarying level outline, and probably more than 1000 feet thick—"a mighty and wonderful object." Ross did not consider this ice-barrier as resting on the ground, for there were soundings in 2500 feet a few miles from the cliffs; Wilkes also sounded in over 5000 feet, only a short distance from the barrier.

There is singular accord in the descriptive accounts by Wilkes and Ross of this ice region; they both dwell on the difference in character of Antarctic from Arctic ice formation, on the tabular form of the upper surface of the floating icebergs, and their striated appearance; on the extreme severity of the climate in mid-summer; of the low barometric pressure experienced—and express equal wonderment at the stupendous forces necessary to break away the face of these vast ice-barriers, and the atmospheric causes necessary for their reproduction.

From the drift of this disrupted ice we have fair evidence of a great bodily movement of the waters northward; for it must be remembered that icebergs have been fallen in with in the entire circumference of the Southern seas, and that they are pushed in the South Atlantic Ocean as far as the 40th parallel of latitude: in the South Indian to the 45th parallel; and in the South Pacific to the 50th parallel.

In the discussion of ocean circulation, it has been assumed that water flows from Equatorial into Antarctic areas; there is no evidence so far as I am aware, that warm surface water, in the sense implied, is found south of the 45th parallel. Surface stream movement northward and eastward appears to be that generally experienced in the zone between the Antarctic circle and that parallel. With, then, this great bodily movement northward of Antarctic waters included certainly between the surface and the base, or nearly so, of these tabular icebergs (and thus representing a stratum certainly some thousand feet in thickness), the question arises, How, and from whence, does the supply come to fill the created void? Sir Wyville Thomson, the leader of the *Challenger* scientific staff, in one of the later of the many able Reports he has forwarded to the Admiralty, furnishes, I think, a reasonable answer. Stating first his views as derived from study of the bottom temperature of the Pacific Ocean generally, he writes:—"We can scarcely doubt that, like the similar mass of cold bottom-water in the Atlantic, the bottom-water of the Pacific is an extremely slow indraught from the Southern Sea." He then gives the reason:—"I am every day more fully satisfied that this influx of cold water into the Pacific and Atlantic Oceans from the southward is to be referred to the simplest and most obvious of all causes, the excess of evaporation over precipitation of the land-hemisphere; and the excess of precipitation over evaporation in the middle and southern parts of the water-hemisphere."

Before following up the great northward movement of Antarctic waters, I would draw attention to a physical feature in connection with tidal movement, which possibly may be one of the many links in the chain of causes affecting ocean circulation. The mean tide-level (or that imaginary point equi-distant from the high and low water marks as observed throughout a whole lunation) has been assumed as an invariable quantity; our Ordnance Survey adopts it as the zero from whence all elevations are given: the *datum level* for Great Britain being the level of mean tide at Liverpool. For practical purposes, at least on our own shores, this mean sea-level may be considered invariable, although recent investigations of the tides at Liverpool and Ramsgate indicate changes in it to the extent of a few inches, and which changes are embraced in an annual period, attaining the maximum height in the later months of the year; these have been assumed as possibly due to meteorological rather than to the astronomical causes involved by tidal theory.

From an examination of some tidal observations recently made near the mouth of Swan River, in Western Australia, during the progress of the Admiralty survey of that coast, there appears to me evidence that in this locality —open, it will be remembered, to the wide Southern seas—the sea-level varies appreciably during the year; thus, the greatest daily tidal range in any month very rarely exceeds 3 feet, but the high and low water marks range, during the year, 5 feet. The higher level is attained in June, and exceeds the lower level, which is reached in November, by 1 foot or more. At Esquimalt, in Vancouver Island, fairly open to the North Pacific Ocean, there are indications of the sea-level being higher in January than it is in June; and a distinct excess of the mean level of the tide by several inches in December and January, as compared with the summer months, was traced by the late Captain Beechey, R.N., at Holyhead (see Phil. Trans. 1848). If this surface oscillation is a general oceanic feature, and some further proofs indirectly appear in the Reports of the Tidal Committee to this Association for 1868, 1870, 1872, to which I have just referred--for mention is also made of a large annual tide of over 3 inches, reaching its maximum in August, having been observed at Cat Island, in the Gulf of Mexico,—we may have to recognise this physical condition, that the waters of the southern hemisphere attain a high level at the period of the year when the sun is to the north of the equator, and that the northern waters are highest at the period when the sun is to the south of the equator. This is a question of so much interest that I propose again to revert to it.

Variations in the sea-level have been observed, notably in the central parts of the Red Sea, where the surface-water, as shown by the exposure of coral reefs, is said to be fully two feet lower in the summer months than in the opposite season; these differences of level are commonly assigned to the action of the winds. Rennell, in his 'Investigation of the Currents of the Atlantic Ocean,' states, on what would appear reliable authority, that, on the African Guinea Coast, the level of the sea is higher by at least 6 feet perpendicular, in the season of the strong s.w. and southerly winds—which winds blow obliquely into the Bay of Benin between April and September, the rainy season also—than during the more serene weather of the opposite season; the proof being that the tides ebb and flow regularly in the several rivers during the period of strong s.w. winds, but that in the other season the same rivers run ebb constantly, the level of the sea being then too low to allow the tide waters to enter the mouths of the rivers. It is possible the cause, here and elsewhere, may in part be cosmical, and neither meteorological nor astronomical in a tidal sense.

These several facts in relation to the variations in levels of the surface of the ocean are interesting, and point to new fields of observation and research.

Another physical feature connected with the ocean-level is deserving consideration: I refer to the effect of the pressure of the atmosphere. On good authority we know that the height of high water in the English Channel varies inversely as the height of the barometer. The late Sir John Lubbock laid it down as a rule that a rise of one inch in the barometer causes a depression in the height of high-water, amounting to seven inches at London and to eleven inches at Liverpool. Sir James Ross, when at Port Leopold, in the Arctic seas, found that a difference of pressure of ·668 of an inch in the barometer produced a difference of 9 inches in the mean level of the sea — the greatest pressure corresponding to the lowest level. These results appeared to him to indicate "that the ocean is a water-barometer on a vast scale of magnificence, and that the level of its surface is disturbed by every variation of atmospheric pressure inversely as the mercury in the barometer, and exactly in the ratio of the relative specific gravities of the water and the mercury." When we consider the exceptionally low barometric pressure prevailing in the Southern seas, and the comparatively low pressure of the equatorial ocean zones, as compared with the areas of high pressure in the oceans north and south of the equator—the latter features a late development by Mr. Buchan—these characteristic conditions of atmospheric pressures cannot exist without presumably affecting the surface conditions of adjacent waters.

There is yet one more point in connection with the ocean circulation which I venture to think has not received the attention it demands; this is, the economy of those currents known as "counter-equatorial." Their limits are now fairly ascertained, and are found to be confined to a narrow zone; they run in a direction directly opposite to, and yet side by side with, the equatorial streams of both the Atlantic and Pacific Oceans. We know that they run at times with great velocity (*Challenger* experienced 50 miles in a day in the Pacific Ocean), and occasionally in the face of the trade-wind; and that they are not merely local, stretching as they do across the wide extent of the Pacific; and in the Atlantic, during the summer months of our hemisphere, extending nearly across from the Guinea Coast to the West India Islands. They have, too, this significant feature, that their narrow zone is confined to the *northern side alone* of the great west-going equatorial currents; this zone is approximately between the parallels of 7° and 10° N., and thus corresponds with the belt of greatest atmospherical heat on the earth's surface.

That the functions of the counter-currents in the physics of the ocean are important, must, I think, be conceded. They appear to act on their eastern limits as feeders to the equatorial currents, and, from the seasonal expansion, which has been well traced in the Atlantic, are probably more immediately associated with some oscillatory movement of the waters, following, though perhaps only remotely connected with, the sun's movements in declination.

A brief summary of the thermal conditions of the oceanic basins will now enable us to review the salient features of ocean circulation, and the more immediate scientific position the question has assumed.

In all seas within the torrid and temperate zones, provided any given area is not cut off by submarine barriers from a supply of polar or glacial water, the sea-bed is covered by a thick stratum of water, the temperature of which is confined between 32° and 35° F. In the Pacific Ocean this cold stratum must be derived from Antarctic sources, for the opening of Behring Strait is too small to admit of an appreciable efflux of Arctic waters. In this ocean the cold stratum obtains generally at depths below 9000 feet from the surface, with an almost invariable isothermal line of 40° F., at from 2500 to 3000 feet from the surface. Similarly, in the Indian Ocean basin, the cold-water stratum at the bottom is derived from Antarctic sources, for the temperature of 33·5° F. underlies the hot surface waters of the Arabian Gulf.

In the South Atlantic, Antarctic waters, with a bottom-temperature of 31° to 33·5° F., certainly cross the equator; the bed of the North Atlantic basin then warms up to 35°—marked diversities in both the temperatures and thickness of the successive layers of water from the surface downwards are found; and in the central parts of the basin it is not until the vicinity of the Faröe Islands is reached that Arctic waters of an equivalent temperature to those from Antarctic sources are experienced.

Turning now to the scientific aspect of the question:—The doctrine of a general oceanic thermal circulation assumes two general propositions: 1, the existence of a deep under-flow of glacial water from each pole to the equator; and 2, The movement of the upper stratum of oceanic water from the equatorial region towards each pole, as the necessary complement of the deep polar underflow—this double movement being dependent "upon the disturbance of hydrostatic equilibrium, constantly maintained by polar and equatorial heat." Proposition 2, in its general application as to the movement of surface-waters, is unquestionable; but that of a deep underflow from the poles, as a necessary complement, remains open to doubt. Proposition 1, in its wide generality, must, from what we know of the Pacific, be confined to the Atlantic Ocean; and it appears to me that it is on the interpretation of the movement of the waters in its northern basin that the hypothesis of a vertical circulation, and the potency of thermal agency in bringing it about, must be judged.

We have followed the movements of Antarctic waters in the Atlantic to the 40th parallel, as illustrated by the progress of icebergs; we know that the movement deflects the strong Agulhas current, and that the cold waters well up on the western shore of the South African continent, cooling the equatorial current near its presumed source; the thrusting power of this body of water is therefore great. About the equator it rises comparatively near to the surface. But we now come to another and distinct movement—the equatorial current; and on this, I apprehend, the material agency of the winds cannot be denied, in forcing an enormous mass of surface-water from east to west across the ocean. The Gulf Stream results, and the comparative powers of this stream, as especially influencing the climate of our own and neighbouring countries, together with the forces at work to propel its warm waters across the Atlantic, have become the controversial field for the upholders of horizontal and vertical circulation. The one hypothesis assigns to the Gulf Stream all the beneficent powers of its genial warmth—extending even beyond the North Cape of Europe—which have been conceded to it from the time of Franklin. The other hypothesis reduces its capacity and power, considers that it is disintegrated in mid-Atlantic, and that the modified climate we enjoy is brought by prevailing winds from the warm area surrounding the stream; and to this has been more recently added, "by the heating power of a warm sub-surface stratum, whose slow northward movement arises from a constantly renewed disturbance of thermal equilibrium between the polar and equatorial portions of the oceanic area."

Without denying the active powers of this disturbed thermal equilibrium—although in this special case it is an abstraction difficult to follow—and giving due weight to the many cogent facts which have been brought forward in support of both views, there appears to be still a connecting link or links wanting to account for the southern movements of Arctic waters, which movements, to me, are even more remarkable as a physical phenomenon than the translation of the warm waters from the Gulf Stream area to a high northern latitude.

This movement of Arctic waters is forcibly illustrated by the winter drifts down Davis Strait of the ships *Resolute*, *Fox*, *Advance*, and of part of the crew of the *Polaris*, when enclosed in pack-ice, exceeding, in some cases, 1000 miles; similarly, of the winter drift of a part of the German expedition of 1870, down the east side of Greenland, from the latitude of 72°, to Cape Farewell. If to these examples we add the experience of Parry in his memorable attempt to reach the North Pole from Spitzbergen in the summer of 1827, it must be inferred that a perennial flow of surface-water from the polar area into the Atlantic obtains, and, judging from the strength of the winter northerly winds, that the outflow is probably at its maximum strength in the early months of the year.

When we further know that the northern movement of warm waters gives, *in winter*, a large accession of temperature to the west coast of Scotland, to the Faroe Islands, and extending to the coasts of Norway as far as the North Cape; the consideration arises whether this onward movement of waters from southern sources is not the immediate cause of displacement of the water in the Polar area, and its forced return along the channels indicated by those winter drifts to which I have referred.

That some hitherto unlooked-for and unsuspected cause is the great agent in forcing southern waters into the Atlantic polar basin has long forced itself on my conviction, and I now suspect it is to the cause producing the annual variations in the sea-level,—for, as I have mentioned, indications exist of the seas of the northern hemisphere having a higher level in winter than in summer,—that we must direct our attention before the full solution of ocean circulation is accepted.

The facts of the annual changes of sea-level, whatever they may ultimately prove, have hitherto ranged themselves as part of tidal action, and so escaped general attention. Physicists well know the complication of tidal phenomena, and, if one may be permitted to say, the imperfection of our tidal theory; certain it is that the tides on the European coasts of the Atlantic are so far abnormal that one of our best authorities on the subject (Sir W. Thomson) describes them, in relation, I assume, to tidal theory, as "irregularly simple," while the tides in all other seas "are comparatively complicated, but regular and explicable." However this may be, specialists should direct their attention to the disentanglement of the variations in the sea-level from tidal action simple; and our colonies, especially those in the southern hemisphere, would be excellent fields for the gathering in of reliable observations.

I am unwilling to leave the subject without tracing some of the consequences that might be fairly considered to follow this assumed change of level in the North Atlantic basin. We can by it conceive the gradual working up of the warmed water from southern sources as the winter season approaches, including the expansion of the Gulf Stream in the autumn months; the consequent welling-up of a head of water in the enclosed and comparatively limited area northward of Spitzbergen, Greenland, and the broken land westward of Smith Sound; the forced return of these glacial waters, their greatest volume seeking the most direct course, and thus working down the Labrador coast charged with ice, and passing the American coast inside the Gulf Stream; while the smaller volume, reaching the higher latitudes in mid-Atlantic, interlaces with the warm barrier waters, causing those alternating bands of cold and warm areas familiar to us from the *Lightning* and *Porcupine* observations, and which are now being worked out by the Norwegian exploring expedition in the Government ship *Vöringen*.

We can further conceive that the larger function of the "counter-currents" on the north margin of the great equatorial streams is to act as conduits for the surcharged waters of the northern oceans consequent on the gradual changes of level. The Atlantic counter-current, we know, expands markedly in the autumnal season, and there may be some connection between this expansion and the high level of the waters said to exist in the Gold Coast and Guinea bights at the same season.

We are thus, as it appears to me, now only on the threshold of a large field of inquiry bearing on the Physical Geography of the sea; but we have this advantage,—the admirable discussions which have taken place in the past few years, productive as they have been of the marshalling hosts of valuable facts, will lighten the labours of those who engage in its prosecution. Science is deeply indebted to, and, I am sure, honours those who have so earnestly worked on the opening pages of the coming chapter on ocean circulation.

2. *The Ascent of Mount Ararat in* 1856. By MAJOR ROBERT STUART.*

THE sun rose in all his glory at Bayazid on the 11th July, 1856. There was not a cloud in the sky to intercept his rays, and, with the exception of an occasional breeze that swept lightly down from the mountains, the atmosphere was calm and still. So far as could be prognosticated in these regions of fierce and sudden changes, the weather was set in fair.

As the Expedition of which we are about to write was novel in its object, and not without importance in its results, it is but fair towards the gentlemen who were engaged in it to give to their names an early and prominent place in the narrative. These gentlemen were as follows:—The Rev. Walter Thursby, Major Fraser, Mr. James Theobald, Mr. Evans, 9th Lancers, and the writer, Major Robert Stuart. Majors Fraser and Stuart and Mr. Evans formed part of a British Staff that, during the war, had been attached to the army of Anatolia. Messrs. Thursby and Theobald were travelling in those parts for their own amusement. It would be too much to aver that the above names will live in the future traditions of the country round Ararat, for English names are distorted into curious shapes by Oriental lips; but in some form or other they will long be remembered with pious respect in the plains and villages of those parts, from their associations with the sacred heights of Aghri-dagh.

Our cortege consisted of Iss-hak Bey, Chief of the Ararat Kurds, to whose special care we had been committed by the Kaimakam of Bayazid, Hadgï Mustafa Effendi, a zaptieh, or native policeman, who, in addition to other functions, acted as interpreter between our party and the Kurds. Our dragoman, a Smyrniote, who figured in the remains of an expensive British Staff uniform and a suridji to take charge of the horses. Punctual to the minute all these functionaries were ready at their posts at the appointed time. Iss-hak Bey presented himself in full costume, armed and accoutred as if for a foray. He was mounted on his favourite mare, a beautiful specimen of the pure Kurdish breed. Undersized to English eyes, she was perfect in the symmetry of her proportions, which exhibited all the indications of speed, strength, and power of endurance; there was a subdued fire in her large gazelle eyes, and her satin skin of bright chestnut was without a flaw, except the brand marks on her head and neck, by which were distinguished her pedigree and the tribe to which she belonged. There was an English Bey whose eyes were long riveted in deep admiration on the Kurdish mare, to the evident gratification of her owner. Covetous thoughts arose; but it was of no use, money could not have bought her. We verily believe that Iss-hak Bey would sooner have parted with his favourite wife than with that mare.

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* Being the hitherto unpublished private journal of the event, by Major Stuart; communicated to the Society by his sister-in-law, Miss Charlotte Cathcart.

Everything being ready, we started soon after the sun had well cleared the horizon. Early as it was the housetops were crowded with spectators as our cavalcade defiled through the narrow streets. Iss-hak Bey took the lead, evidently elated with the honour and responsibility of his charge. He rode on in dignified silence, gracefully waving at times his long tufted lance, the shaft of which was of best Persian bamboo, as springy as whalebone, and as tough as an oak. The zaptieh also was brimful of importance, but he showed it in a different manner; silence formed no part of his character, and in the choice phraseology of the bazaars it would perhaps have been difficult to find his rival. Moreover the nature of his calling had invested everything vagabond with an attraction for him; and woe betide the ragged urchin or poverty-stricken wretch that came within reach of his kurbash. But after clearing the town, all this ceased; pipes were lit, pleasant chat sprung up, and by degrees everything settled into the order of the day's march. Arrived on the plain, we bore off in a direction north-east, passing on the left some fields which had formerly been enclosed and cultivated as vineyards. In 1829 they were laid waste and utterly destroyed by the Russians, and to this day they remain in the condition in which they were left by these remorseless enemies. An elevated rocky ridge, forming a natural escarpment and extending from the summit of the mountain, on which Bayazid is built, to the plain, shelters the town to the east. On doubling the lower extremity of this ridge, we obtained for the first time a full view of the stately Ararat from the base to the summit.

The snow-clad cone stood out in distinct relief against the morning-sky, cold, grand, and forbidding. By some perspective illusion, the lesser peak, though 4000 feet lower, and some miles more distant, seemed the higher of the two. This can be explained by the principles of optics; but we fear in a manner that would not interest many of our readers. One useful lesson, however, may be learned from this fact: namely, that travellers should be careful in trusting to first impressions, seeing that the senses are apt to be misled when first brought into contact with unaccustomed objects. We now struck off in a north-easterly direction across the plain. One hour from Bayazid we came to the Shekheli, a deep narrow stream as clear as crystal, that, collecting the watershed of the adjacent mountains, winds round the base of Ararat and unites with the Arras. We traversed this stream by means of a handsome one-arched bridge of Genoese construction, much impaired, like all its kindred works in this country, by the hand of time and the roughness of the elements. The parapets have been swept away, the foundations show signs of weakness, and the traveller of next year will perhaps find it gone.

The plain of Bayazid, unlike those of Alishkurd, Passine, and Erzeroum is, for the most part, barren and repulsive, yielding nothing but a sparse, lank grass, insufficient for pasture. The soil is everywhere stony and the stone volcanic. After crossing the Shekheli we observed much that would interest the naturalist: small lizards of a brown colour were in some places so numerous that they started aside in scores from every footfall of our horses, while at the same time swarms of large red-winged beetles buzzed pertinaciously around us, and every now and then we crossed the shiny trail of snakes; gray partridges abound on the stony ground at the foot of the mountains, crows and swifts are seen in scanty numbers, and further on some indications of man appear in the few wretched villages which, without inhabitants in summer, form the retreat of the Ararat Kurds when the approach of winter drives them from the heights. Here the plain assumes a more genial aspect, extensive meadows and cornfields meet the view, and beyond these was a forest of tall reeds where, according to our zaptieh, wild swine make their lairs, while bears and wolves are to be found in the neighbouring heights. Thus far we kept to the plain, skirting the base of the mountain and following the salient and re-entering angles of its shoots. But at length, after doubling a surging projection composed of broken masses of basalt, we struck to the left and commenced the ascent through a broad opening enclosed between vast ridges of volcanic formation. For the first hour after quitting the plain, the ascent was, with a few rough exceptions, easy and gradual. Our path followed the windings of a noisy stream which irrigates at intervals in its course patches of fertile land, yielding at this season wheat, or barley, or hay. On one of these plateaus, which spread out to some acres, a halt was unanimously agreed upon. Off-saddling and knee-haltering our horses, we gave them the range of the pasture, where they enjoyed their brief respite from toil, rolling, grazing, and fighting by turns.

We were soon reseated in our saddles, and now our way constantly increased in difficulty, becoming at every step more rocky and acclivitous. Our trusty little horses were, however, perfectly at home at this work; with the agility and circumspection of a cat, they carried us safely and jauntily over ground that would try the nerves of any one not accustomed to the horsemanship of Armenia.

After an hour or so of this tedious work we reached what might be designated the shoulder of the mountain. Here the ground became easier, the plateaus more frequent and extensive, and sheltered spots presented themselves suitable to the abode of man. The climate too was gradually changing for the better: instead of the hot air of the plain we were now inhaling a light breezy atmosphere, tempered with an occasional dash of cold, as every now and then a gust of wind fresh from the upper snows swept down upon us. With the advance of day a mantle of rolling clouds had gathered round the cone; near at hand, however, there was enough for present interest. We were now about 5000 feet above the plain, and as we were slowly working our upward way we came upon the first encampment of the Ararat Kurds. It was situated in a sheltered hollow where there was good water and green pasture in abundance; the black tents of Kedar harmonised well with the character of the surrounding scenery, while the dwellers therein, with their swart faces, piercing eyes and outlandish dresses, gave the finish of life to the whole. Our unexpected arrival and strange appearance created an immense sensation amongst these wild people. They turned out in crowds to see us, but hospitality was their first thought; wooden bowls of "Iran," or sour milk diluted with water, were brought forward in quick succession, and not until we were sufficiently regaled did they give way to their curiosity: then old men and maidens, haggard gypsy-like women and young children, all gathered round to survey the strangers from Frankestan; even their dogs, which, by the way, are famed for strength and ferocity, manifested their excitement by a sustained chorus of angry barking.

Pushing on thence, we passed these detached encampments at frequent intervals; and at 3 P.M. we reached the quarters of the chief himself, at an elevation of about 6000 feet above the plain. It appeared that on the preceding day he had sent off an express to give notice of our intended visit, and everything was accordingly in readiness on our arrival.

A large portion of the chief's tent had been walled off for our use, the floor was covered with their best Persian carpets, and Kurdish taste and appliances were taxed to the utmost in order to produce an imposing effect. We were not long in making ourselves at home. Our horse gear and baggage were brought into the tent and conveniently stowed away; the horses, picketed in front of the huts, were consigned to the care of the women, pipes and coffee were served, and Iss-hak Bey, in the character of host, waited on us with due ceremony and bade us welcome to his tent. While the chief was sitting with us, his people began to collect in numbers at the tent door, watching our every movement with those keen black eyes of theirs, which, glancing with incessant motion from beneath thick shaggy eyebrows, seemed to possess superhuman quickness and power. By a benevolent appointment of nature those faculties upon which we are most dependent are mostly invested with additional efficiency in proportion to the services required of them. The Kurd may be said to live by his eyes, whether it be in spying out his quarry afar, or in detecting the stealthy movements of his enemy, or in reconnoitring the intended scene of his forays. His vision, thus constantly exercised from childhood, acquires an almost telescopic power; and on many occasions during our sojourn amongst them we were amazed at the quickness and range of their sight. The Kurdish women are free from the affected coyness of their Turkish and Armenian sisters. In the crowd assembled, as we have said, at the door of the tent were several women, and even the Bey's wives did not stand aloof. He had two of them: one an elderly dame, whose province it was to superintend rather than to perform the domestic duties; she was a hard-worked shrivelled creature, with nothing to distinguish her from the humblest of her sex in the encampment. It was far different with the other, who, it will at once be perceived, was the favourite wife. She was still young, perhaps not more than twenty-five, although in appearance more aged than an English woman of forty. And yet she was exempt from the drudgery which so soon breaks down her less favoured countrywomen. Good-looking for a Kurdess, and rather tall, she had evidently taken much pains to improve her natural advantages by dress. A minute description of her would not be interesting; but we may observe that her ornaments consisted of a profusion of gold coins which were strung thickly together to form her forehead band, necklace, and bracelets. Several times during our stay she came into our portion of the tent under the pretence of looking for some mislaid article, and was evidently much pleased with the respectful manner in which she was received.

Our conversation with the Bey, as he sat among us, naturally turned on our projected expedition. Many were the arguments and earnest the entreaties he used to dissuade us from it. The latest attempt, he told us, had been made by a Russian Bey some twelve years ago, who came with a large party and great preparations. According to custom, sheep were sacrificed at the base of the cone to propitiate Kissmet (fate), and a portion of the flesh was taken up by each man; but all to no purpose: they could not get to the top, and it was with difficulty they all got back alive, for some were snow blind, some were frost-bitten, and one had his leg broken (this was Professor Abich and his party, of whom more hereafter). "Kissmet," added the Bey, "forbade the attempt, and who can prevail against Kissmet?" "But," observed an English Bey, "our Kissmet is different from yours, and what is forbidden to you may be allowed to us." "True," replied the Kurd, "God is great, and you English are wise; it is not to for us to say what you can do." "Inshallah!" exclaimed the listeners at the door. After this no question on the subject was again started.

The tribe of which Iss-hak Bey is chief, numbers about five hundred men. During the summer months they are distributed in detached encampments over the southern shoulder of the mountain, where, in the sheltered dells, and on the green slopes, they find crystal rills and sweet pasture in abundance; while farther down, towards the plain, every patch of available soil is appropriated to hay or cereal crops. Each encampment numbers some six or eight tents, all of black goat's hair, the spinning and weaving of which forms, as has been before observed, an important part of female employment. Here a primitive and apparently happy state of society exists, under a government strictly patriarchal. Each encampment has its own little chief, who again is subordinate to the Bey. Mixing little with other tribes, or with any beyond their own sphere, they are almost unacquainted with barter; their wants are consequently few and simple, and such as each family can make provision for. With good tents, warm clothing, and wholesome food in abundance, their condition may well be envied by many whose lot is cast amid the boasted advantages of civilization. With them there is no poverty; their disquietudes are few and transient, their bodily ailments light and easily healed. The women labour cheerfully in the tent and in the field, while the men saunter about in idleness, never going without arms, so as to be prepared for any danger or temptation that might unexpectedly arise. Amongst themselves there is a bond of mutual honesty and fair play; but in his dealings with all others, the Kurd is an unblushing avowed rogue and cheat. Every tent is guarded by its own special dogs—large, strong, savage animals; and so faithful to their charge, that they will not allow dog or man of another tent to invade their beat. They made a terrible row when we came first amongst them, but they were not long in recognising in what position we stood. The Bey's dogs at once fraternised with us; but the others, though consenting to our presence in the camp, would warn us off whenever we approached their tents, until they saw how it was between us and their masters.

These Kurds, as has been already stated, change their place of abode with the seasons. In the month of May, when the winter is well past, and spring vegetation has made some progress, they move with their penates, families, and all they possess, to the heights, returning to the plain towards the end of September, when frequent atmospheric commotions announce the dangers of a prolonged stay at such an elevation.

Their villages in the plain, which are thus deserted for several months in the year, are of the most primitive description, being nothing more than mud contrivances; in which the inmates, sheltered from cold, pass a long hybernation, in company with their horses, sheep, and cattle, besides vermin of different sorts in visible swarms.

While we were thus engaged in pleasant converse with our host, active preparations were going on elsewhere for our evening meal. A goodly odour of stews and kibaubs arose from the neighbouring tent; and the Kurdish *chef-de-cuisine*, aided by our own servants, exercised his utmost skill in producing a repast worthy of English Beys. Before it was served, the younger son of Iss-hak Bey, a handsome lad about ten years old, came into the tent, and, with becoming grace, presented us each with a bouquet of wild flowers. The elder brother was a couple of years older. He was weakly, and of tender eyes. The father brought him to us in hope that we might be able to prescribe for him. Alas! we could do nothing. The father then, after tenderly caressing him for awhile, shot into each eye a plentiful discharge of spittle, upon which the grateful youth bowed reverently and retired. Our evening wore away agreeably enough. By degrees all noises ceased throughout the camp, until perfect silence prevailed at an early hour, for this primitive people lie down and rise with the sun.

Rising with the first streak of dawn, the "fingan" of hot coffee was soon got ready and circled round. Every man charged himself with a small supply of provisions and a coil of strong jack-line in addition to his trusty pole with an iron spike at one end and a hook at the other. We had also among us a race-glass, a small hatchet, and a leather bottle of rum. Thus equipped we started off in full confidence of success, being accompanied by

Iss-hak Bey and the zaptieh on horseback, and two or three men on foot. There was, however, one drawback to the anticipated pleasure of the day, namely the illness of the Rev. Mr. Thursby, by which we were deprived of his company. This illness, which happily was not of a serious nature, had come on during the night, and, as he required nothing but repose, we thought we might safely entrust him to the care of our Kurdish friends.

For the first hour or so our progress was comparatively easy, the ground differing but little from that which we had traversed on the preceding day—the same green plateaus, well watered and in some places sheltered by huge ramparts of volcanic rock. At an hour's distance from the Bey's quarters, we came upon the most elevated of the detached encampments. It numbered seven tents, and was situated upon an extensive well-watered plateau, about 6000 feet above the level of the plain. Beyond this the aspect of nature became at every step more sterile, wild, and forbidding. The radiating ridges of basalt increased in height, became more rugged and impracticable. A track, known only to the mountaineers, enabled us, however, to make tolerable progress. After two hours we were obliged to relinquish our horses; for it was now a scramble up and down precipices, and over masses of broken rock, where only men or mountain-goats could find footing. It was pleasant to see every now and then, amid all this desolation, a patch of green peep out from beneath some sheltered nook, on which was to be found in abundance forget-me-nots, double daisies, gentianella, and primulas, all growing in unromantic fraternity with wild shalots. After three hours of stiff work, we arrived at the foot of the cone, which, owing to the continued fineness of the weather, we were enabled to see to the very summit; and it was no ordinary sight. We stood in the immediate presence of the vast cone-shaped mountain, 6000 feet high, covered with eternal snow to the very base!

Arrived at the foot of the cone, our Kurdish friends declined proceeding any further, and we held a consultation as to the best mode of ascending. Independence of thought and action is the well-known characteristic of Englishmen. This spirit, we need scarcely say, manifested itself in our council. The end of it was that three decided upon trying the ascent on that part of the mountain that lay just in front of us, keeping as much as possible to the snow, while the fourth, Major Fraser, chose a line for himself, bearing away to the right, in the intention of availing himself as much as possible of those parts from which the snow had disappeared. His reasons were good. He had had much experience in rough mountain work in South Africa, where snow is unknown, and he did not deem it prudent on the present occasion to essay an element that he had not proved; whereas of the others, two were experienced Alpine travellers, accustomed to glaciers and eternal snows.

For the present, leaving Major Fraser to himself, let us follow the movements of the others. The line of ascent being determined on, the grand work of the day began in real earnest. It was now six o'clock, and we had already been three hours on foot, working upwards against difficulties of no ordinary character; but as yet no one dreamt of fatigue; on the contrary, it appeared as if these three hours had been but a preparative for the day's work. A bit of unleavened bread, and an occasional mouthful of snow, served to sustain the strength and to ward off hunger, without loading the stomach or touching the wind—the two great evils to be avoided on occasions of great bodily exertion. For some time we held pretty well together, making on the whole satisfactory progress. But, after the first 1000 feet put differences in our climbing powers, the snow, with which previous experience had familiarised Theobald and Evans, sorely taxed the unaccustomed limbs of Major Stuart, who accordingly turned aside to a projecting ridge of broken basalt, which extended far up towards the summit. To one standing at the foot of the cone this ridge would present the appearance of a paved road, but it consisted in reality of huge masses of basalt, thrown together by volcanic force in making way over which the utmost agility and circumspection were required to guard against the chances of broken limbs.

At this time Theobald was some hundred yards in advance. Evans and Stuart had so far held pretty well together, but the latter now giving in, the former followed, with gradually increasing interval, on the traces of Theobald. On, on they went, higher and higher; now lost to sight in a fleecy cloud, now re-appearing, but diminished to little moving specks on the upper snows. The higher they ascended the greater the difficulties they had to contend with. As the air became more rarefied the action of the lungs was quickened, and every effort told more sensibly upon the strength. At the same time the angle of the slope continued to increase, while the footing became more difficult, because the upper part of the mountain is perpetually coated with an encrustation of ice, lightly sprinkled over with snow. For, during the summer months, the heat of the sun is sufficiently powerful to melt the snow in those elevated regions whenever the absence of clouds and mists permits his rays to have their full force; but let them be intercepted but for a moment, and their effects are counteracted by the normal temperature of the atmosphere, which at all seasons is below freezing point; over the icy crust thus formed the snow, swept from the neighbouring drifts by the never-ceasing wind, collects in a thin layer as fine and as dry as powder, deep enough in some places to conceal what is beneath, but not to afford a firm foothold.

The utmost circumspection is consequently required at each step in climbing this part of the mountain; and the spiked staff will be found of invaluable service, as well in sounding the surface as in aiding the precarious efforts of the feet. Theobald and Evans, as has been already noticed, were experienced Alpine climbers, and, being strong of limb and sound of wind, they held successfully on their upward course, without check, slip, or drawback, until at 2 o'clock P.M. the former crowned the final difficulty, and found himself on the summit of Mount Ararat. He was followed at an interval of about an hour by Evans, who, though less active, had equal perseverance.

Leaving them for a while to their own musings on this solemn height, let us now return to Major Stuart, whom we left, some three or four hours back, in an exhausted state 4000 feet lower down. A feverish cold, from which he had been suffering for some days previously, had much impaired his strength, and thrown him out of that condition necessary to the performance of a severe or protracted physical effort. He did not feel this at starting; the excitement of the occasion, the first flush of returning health, and the bracing effects of mountain air, had inspired him with a premature confidence in his own strength. As we have seen, he got on very fairly for a time, holding his own with the others; but the undertaking was beyond his force, and he was obliged to give in after ascending about 2000 feet of the cone. Sitting down under the shelter of one of those masses of basalt over which he had been climbing, a drowsy feeling came over him, and he was soon fast asleep. In about an hour he awoke somewhat refreshed, and, on looking around, he found himself the object of attentive consideration to a number of ibises grouped on a rock close by, from whence they could carry on their survey in safety. Curiosity and astonishment had imparted increased lustre to their beautiful eyes as they examined with earnest gaze this strange intruder on their domains. On perceiving him move they bounded away, springing with light unerring foot from point to point over the rocks, and soon were lost to view. What had led them up so far it would be hard to say, for at the level of 13,000 feet above the sea there is no vegetation except some scanty lichen, which could not serve for food to these animals. Some small birds were also seen on the wing at this height, but of what species there was not sufficient opportunity of udging. Above this all was solitude, silence, and snow.

Major Stuart, finding himself unable to proceed higher, now addressed himself to the task of descending. To accomplish this step by step would have been too laborious; he therefore resolved to try what could be done by a glissade. The angle of the mountain-slope with the horizon was in this place about 35°. Taking his seat then on the snow, he looked well to his balance, steadied himself with his staff, and, giving way, off he went like an arrow shot from a bow, and in the course of a few minutes he found himself once more safe and sound at the foot of the cone. Iss-hak Bey, who, from a convenient position, was keeping close watch on every movement of our party, sent forward one of his men to meet the unsuccessful climber, received him with every demonstration of respect when he joined him, gave him his pipe and bade him welcome. "The English Bey is, no doubt, very brave and very enterprising," said he, "but he has attempted what is beyond the strength of man, and what, according to the traditions of my race, is contrary to the will of Allah. You were wise not to ascend any higher, and my heart is throbbing for the two other noble Beys who are at this moment hidden from view far up among the driving mists, Allah Kerem (God is good)." "Fear not, great chief," replied the Major, "they are younger and more active men than I am, and, Inshullah, they will succeed." "Bakalum" (we'll see), was the only rejoinder; and the Major, returning to the chief his pipe, lay down on a green spot, sheltered from the sun's rays by an overhanging rock, and fell into a profound sleep, more grateful than Sybarite ever knew on bed of roses. From this almost comatose state he was suddenly recalled to waking existence by the exclamations of Iss-hak Bey and his attendants. Theobald had just gained the summit of the mountain; at that moment there was not a cloud to intercept the view, and, notwithstanding the great height and distance, the Kurds were able with the naked eye to follow all his movements. "Mashallah!" cried the chief, "God is great, and you English are wonderful people! We have always thought, and our fathers before us thought, that God had made that holy mountain inaccessible to man; many have tried to ascend it, but no one has ever succeeded until you come, and without any preparation walk straight up from the base to the top. Allah be praised! we have heard strange things of you, but now we see them with our own eyes." All this time the Kurds were straining their keen, dark eyes towards the mountain-top, and exclamations of surprise, uttered in their native tongue, followed in quick succession as they watched the movements of the two climbers. The power of vision possessed by this people is truly astonishing; almost equalling that which Europeans attain by the means of telescopes. It can only be accounted for by the constant activity imposed upon the organ by their social habits, to which perhaps may be added their simple diet and the purity of the atmosphere in which they live.

As has been already mentioned, Mr. Theobald was the first to reach the summit; it was about two o'clock when he gained the highest point, where, after somewhat less than an hour, he was joined by Mr. Evans. After making a few observations as to the shape and extent of the top, they commenced together the work of descending, and, keeping closely to their tracks of the morning, they got back in safety to the tents at 6.30 P.M.

We must now follow the movements of Major Fraser, who, it will be remembered, chose a line of his own. Diverging from the point where the others commenced the ascent, he skirted the base of the cone until he found what appeared a more practicable slope on the south-eastern side.

The plane from this point to the summit was apparently even and unbroken, and presenting an uninterrupted surface of snow, it seemed to promise easier work for the feet and in general greater facilities of ascent: therefore, notwithstanding the want of previous experience in snow-climbing, he determined on this line. As long as the snow was soft he found the work easy enough; step by step for hours he industriously kept a direct course, and had got within 1000 feet or so of the summit when he began to experience the difficulty of footing arising from the icy incrustation already described. In attempting to strike across to what appeared an easier line, he slipped in stepping on a sheet of ice lightly covered with snow, and, losing all control over himself, downwards he went with a rapidity which promised to bring him quickly to the point from which he started in the morning. Utterly unable to arrest his downward course, all he could do was to keep himself well on his back, body rigid, and legs stuck out. Natural instinct suggested these precautions; without which he might have spun round like a trencher, been deprived of consciousness and lost. As it was he came off unhurt. After a glissade of 1000 or 1200 feet, the snow, becoming deeper and softer, collected in such quantities between his legs as gradually to retard his speed, and at length it brought him to a stop. But now what was to be done? the loss of so much time, distance, and labour in an undertaking of this kind was certainly most serious, but failure from a cause of such trifling sound as a mere slip of the foot would have been worse than mortifying, it would have been ridiculous by his easy ride over the snow; so readjusting his nerves, and bracing up his energies for a renewed effort, he made his way with some difficulty across the snow to a ridge of basalt that, commencing near the summit, extended downwards about 2000 feet. This ridge consisted of masses of basalt, and over its crest Major Fraser now sought to make his upward way. Such resolution deserved its reward; by dint of great labour and perseverance he succeeded in gaining the summit at about 3·30, having exchanged signals with Theobald and Evans, who had by this time accomplished some hundred feet of the descent. After reaching the highest point, he kept to their tracks in descending, and got back to the tents at midnight. His return was hailed with great satisfaction by the rest of the party, who, as night wore on, had become more and more anxious for his safety; for it is easy to conceive how great are the dangers to which one would be exposed at night on those rugged heights with no light but the delusive glare of the snow and no shelter in the event of one of those sudden storms which often burst with terrific violence in elevated mountain regions. Our apprehensions had, nevertheless, yielded to the presence of fatigue, and we were all sunk in sleep and forgetfulness, when the fierce barking of the watch-dogs recalled us to consciousness, and before we could well collect our scattered thoughts, the Major entered the tent accompanied by a guide, whom he had procured at the upper encampment. A light was instantly struck, refreshment ordered, and while these were forthcoming we listened with breathless interest to the narrative of his day's adventures.

The Bey and some of his chief men were not long in making their appearance. They had altogether relinquished the hope of seeing the Major again, looking upon him as the victim which must needs have been sacrificed for what they considered an enterprise of temerity and folly; but when they saw him back amongst them, unscathed in life or limb, then indeed they began to feel the force of what we asserted, viz., that many things forbidden to the Kurds are allowed to the English.

When the Major had finished his repast, the chief retired, and sleep and silence again reigned in the camp until dawn. For these simple children of the mountain imagine in their innocence that the hours of darkness were designed for repose, of daylight for activity; they retire, therefore, with the sun, and wake up ere his earliest beams gild the eastern hills. There certainly is a charm in this mode of life, to be appreciated by those only who have tried it; and never is the sense of life more bounding and joyous than in the morning, when, rising with the sun, we sally forth into the fields and inhale the breeze still fresh with dew. It must be confessed that none of our party was disposed for this sort of enjoyment on the morning succeeding the events we have just related; for in addition to the fatigue resulting from a day of such unusual toil, two of them were suffering from severe inflammation of the eyelids, brought on by the glare of the snow. As they were unable to bear the light, they remained in the tent for the greater part of the day, their eyes bandaged with a wet towel. By this means the inflammation was soon reduced, and in the afternoon they were sufficiently recovered to go about as usual. We have now done with the ascent as performed by Major Fraser and Messrs. Theobald and Evans. If the subject is not worn threadbare, we would ask the reader to accompany us while we briefly relate how the same feat was accomplished by the Rev. W. Thursby and Major Stuart. It may be said that we are going a second time over the same ground. This is substantially true; but still there will be found some features of separate interest not altogether unworthy of attention.

They set out early in the afternoon of the 13th July, having decided upon devoting two days to the work. On the first, to ascend as far as might be deemed safe before sunset; then sheltering themselves as well as they could for the night, to finish the task on the following morning. Two young Kurds accompanied them from the tents, carrying their rugs and sheepskin cloaks, together with a small supply of provisions, consisting of unleavened bread, cold mutton, a small flask of brandy, and another of tea. Very little experience suffices to show that in threading difficult passes or breasting steep ascents, nothing is more injudicious than haste, or more fatiguing than a false step. The muscular effort necessary to retrieve the latter takes more out of a man than a hundred paces surely and effectively made. Aware of this fact, Major Stuart and his friend proceeded slowly and cautiously, husbanding their force with the utmost care, and looking well to their footing at every step. By this means they reached the foot of the cone with strength still unimpaired. They then turned off towards the south and began the ascent on a part of the south-eastern flank, which the combined action of sun and wind denuded in summer time of snow. By 6 o'clock P.M. they had gained an elevation of about 2000 feet above the base of the cone, and here their Kurdish attendants came to a stop and refused to proceed any further, alleging in justification ancestral traditions and the fear of treading on hallowed ground. The attempt to combat such arguments would have been a simple waste of time and words. In point of fact, the young Kurds had ascended higher than had been expected of them. They were accordingly dismissed in the most gracious manner possible; but to ensure their return in the morning for the rugs and coats, it was deemed advisable to detain their guns and swords, assigning as a reason the danger of wild beasts or robbers. There was some difficulty about this, for the Kurd does not feel to be himself without his beloved weapons; but every objection was overcome by the promise of bakshish (reward), a mode of persuasion by which we verily believe the Kurd could be induced to lay down his life, much more his arms. Major Stuart and Mr. Thursby, now left to themselves, set diligently to work to prepare shelter for the night. The wind was from the west, and blew sharp and strong. About 700 yards to their left, and nearly on the same level with them, lay a field of glaciers, the only ones to be seen on the southern slopes of the mountain. Their halting-place was on a mass of limestone-boulders that varied in size from one to five feet in diameter. To their right was a bed of snow, along the inner edge of which trickled a little thread of water, which no doubt was produced by the heat of the limestone acting on the snow Here, on the lee side of the stony bank, they scooped out a hollow by removing the boulders, and piling them up to windward, they secured to themselves complete shelter from the wind. By a handy adjustment of the boulders, a tolerably level surface was obtained, six feet long by four in width, on which they could both lie down; they chose out a couple of smooth stones for pillows, and thus, with the addition of rugs and cloaks, no bad resting-place was prepared for the night.

Sunset was at hand by the time these operations were completed, and our adventurers now sat down to contemplate without distraction this glorious spectacle. The day had been fine throughout, and at the time we speak of there was not a cloud in the sky, nor a particle of mist to be seen in the vast horizon around. The sight, travelling far over the mountains and plains of Georgia, Azerbijan and Kurdistan, was fairly lost in space and found its limit only in the dim amalgamation of earth and sky. The Araxes flowed eastward a mere thread of silver on the darkening landscape, and the lofty mountains of the panorama in front seemed dwarfed by comparison in their proportions. Bright sunlight shone above, while the shades of evening were gathering on the lands beneath. These shades continued to deepen as the sun dipped lower on the horizon, until at length the darkness of night set in on the plains, while the upper regions of the mountain were still clothed in light. As long as light lingered in the western sky, the vast shadow of the mountain was to be seen stretching far away eastward, and clearly defining its form on the distant horizon.

The fine weather of the day did not change when darkness set in, and glorious was the sight when through the clear ether the hosts of heaven shone forth with a brilliancy and living lustre that almost dazzled the eyes. Far above the reach of lowland exhalations and in a highly-rarefied atmosphere one almost feels the presence of the heavenly bodies. Our two friends felt all the influence of this glorious sky, and of the position in which they were. Behind them was the snow-clad peak of the ancient mountain, carved, as it were, out of the dark sky. In front was the lesser mountain, regular in outline and symmetrical in form. There are many who believe that the Aghri Dagh of Armenia is identical with the Mount Ararat of Holy Writ—others again affirm, and not without strong reasons, that on the subsidence of the Flood the Ark rested on Ghibil Indi, a mountain of Kurdistan. Without pretending to weigh the merits of these conflicting opinions we may observe that the popular belief throughout Central Asia is favourable to the former. The Kurdish tribes who dwell on the slopes and at the base of the Aghri Dagh, and whose forefathers have been there since the earliest dawn of history, the native Christians of Georgia and Armenia—all indeed who preserve the traditions of the land—are familiar with the story of the Deluge. Their account of that great event varies but slightly from that which has been transmitted to us by Moses, and they hold it as part of their faith that Noah's Ark rested on Aghri Dagh, that the hull still remains on the summit deeply buried out of sight, and investing with a sacred character the place thus chosen to be, as it were, the second cradle of the human race, they believe that to scale the mountain is not only impossible, but that any attempt of the kind would be followed with the immediate displeasure of Heaven. The failure, often disastrous, which, as they allege, had attended all such previous attempts were well calculated to strengthen this belief. They have a distinct knowledge of every visit made to the mountain by adventurous travellers within the last fifty years, and Iss-hak Bey furnished us with many interesting details of the dangers which some of them had run and of the accidents which befell them in vainly endeavouring to gain the summit. He remembered all about Parrott's attempt in 1829. Parrott tried on the north side, but signally failed. Nevertheless, he published an account of his expedition, in which he took credit for complete success. The description given by him of the top has been adopted by the editors of the 'Imperial Gazetteer,' viz.: "Top gently vaulted, nearly cruciform surface, about 200 paces in circuit, towards east this summit is connected by a flattish depression with another summit distant 397 yards."

This description is confirmed by Professor Abich, who, acting under instructions from the Russian Government, made the attempt in 1845, and according to his published narrative, reached the summit with six companions on the 29th July.

Now, Iss-hak Bey had distinct knowledge of the particulars of Abich's expedition as well as of Parrott's, and pronounced it, like the rest, unsuccessful—of which, by the way, further proof will be given as we proceed. As to the description above given, it varies almost irreconcilably with the observations of every individual of the party whose successful performances we are now recording. The summit, as seen by them, is in the form of a scalene triangle, the base, which is on the eastern side, lying nearly due north and south, being about 100 yards in length, the perpendicular about 300 yards. The base forms a ridge with an elevation of 15 yards at the southern extremity, subsiding gradually towards the north where it merges with the level of the summit. The apex of the triangle is the highest point of the mountain; separated from it by a dip, 70 yards wide and 25 deep, is another point which attains very nearly the same height. The area of the triangle is level, or rather slightly concave, suggesting the idea of an extinct crater. Such is the summit of Mount Ararat according to the concurrent observations of our party; we leave to others the task of accounting for the discrepancies which exist on this subject between us and other writers. Hundreds of Kurds were eye-witnesses of our ascent. These same Kurds confidently assert the failure of the travellers whose names we have quoted and of all others by whom the attempt had been previously made. To their testimony we may add that of Mr. James Brant, who, from 1835 to 1855, filled the post of British Consul at Erzeroum. The accuracy and extent of this gentleman's information as a traveller, as a man of science, and observer of passing events, give great weight to whatsoever he may say on matters connected with Armenia.

In walking on the summit of Mount Ararat one sinks about midway to the knee in the snow, which is so fine and dry, that it does not adhere to or wet the boots; but it rises like dust to the wind, blinding the eyes and penetrating the clothes and pockets. The rocks on the sides of the mountain consist chiefly of trachyte porphyry, and the effects of strong volcanic action may be seen wheresoever the natural surface is exposed. There are deep gorges, precipitous cliffs, and ridges of broken rock, from which masses occasionally detach themselves and roll to the bottom, leaving deep furrows on the snow, over which they pass. There are two extinct craters on the eastern side of the mountain, just above the saddle, which connects it with Lesser Ararat: one on a level with the bridle-path, which communicates with that part of the mountain; the other a thousand feet higher, to reach which one must climb a steep incline formed of lava and scoria. Lava, scoria, and pumice have also been found in other parts of the mountain; and from an exposed spot near the summit, there is a strong sulphureous emanation; while the parts immediately adjacent are warm to the touch. We may observe, that on this spot are to be found particles of mica, some of which are as large as a kidney-bean. Here there had evidently been volcanic action, for the surface consisted chiefly of triturated scoria and other volcanic substances. It will be remembered that in July, 1840, there was a violent eruption, which seemed to issue from a large natural chasm on the north side. This eruption destroyed the ancient monastery of St. James, and buried in ruins the village of Arguri, situated more than 6000 feet above the level of the sea, and rendered venerable by the Armenian tradition, which indicates it as the place where Noah planted the vine after his descent from the mountain, Arguri signifying in the Armenian language, "the planting of the vine."

At length the first dawn of day appeared, that cold pale light that spreads over the eastern horizon when the sky is clear of clouds and the atmosphere of vapours. Rising from their bed of stone, our travellers addressed themselves at once to the work before them, in high spirits at the prospect of continued fine weather. A few mouthfuls of unleavened bread served them for breakfast, for they decided, wisely, as we think, to trust as long as possible to the strength of the ample dinner they had made overnight, by which means the lungs would be less impeded in their functions; they would have more room to expand in the act of respiration, and the system would consequently suffer less from the effects of the rarefied air. Were this plan more generally adopted by mountain climbers, we should hear less of failures from apoplectic symptoms, such as difficulty of breathing, vertigo, blood rushing to the head and escaping through the ears and nostrils, all of which result from a full stomach, or from a fulness of habit, either chronic or temporary, which circumscribes the action of the lungs at a time when their utmost capacity is required to obtain a sufficient supply of oxygen from the rarefied atmosphere. Most healthy men possess a reserve of strength that will carry them through a heavy day's work without food. The stomach, especially in the case of persons accustomed to regular and generous diet, may rebel against this; but after the first few murmurings, it will settle down into a sullen acquiescence; and in such situations as we are now speaking of, the more vigorous action of the lungs will go far to supply what may be wanting.

Major Stuart and Mr. Thursby had soon full proof of the truth of these remarks. Quietly and steadily they moved upwards, making as little effort as possible, husbanding their forces, looking out the securest footing, and halting at frequent intervals. They climbed cat-like over difficult projections, or along the face of perpendicular escarpments, they hung to butting cliffs, traversed inclined sheets of ice as smooth as glass, and poised themselves on giddy pinnacles of rock. Hour after hour this laborious work continued, but, thanks to the system they had adopted, without producing fatigue, or sensibly taxing their strength.

They were marvellously aided, too, by their iron-tipped staves. The staff is to the mountain climber what the oar is to the Laplander, the helm to the ship, the break to a carriage. It helps him in all his movements, ascending and descending. If he makes a false step, it enables him to recover himself. Is the incline difficult it serves the ascent as an extra limb of ten-leg power, on the descent as a drag or lever; does he fancy a glissade down the snow, with it he steers his course, checks or modifies his speed, or brings to at pleasure. In fact its uses are so varied, and so applicable to every situation, that it must be considered an indispensable part of the mountain traveller's equipment.

On a rocky spot, about 1200 feet from the summit, and under the western lee of a high mural ridge, is a cross, which records the expedition of Professor Abich in 1845. It is made of oak, the upright being 7 feet above ground, the transverse bar 3 feet in length, and it is firmly wedged in between two large masses of rock that lie close to each other. From the action of the weather the surface of the wood has become so soft that it may be scraped off with the nail of the finger to the depth of one-eighth of an inch. On a brass plate 6 inches by 4, screwed on at the inter-section of the bars, is engraved in Russian the professor's name, and the date of his ascent. Several mutton-bones, partially decomposed, lie about at the foot of the cross, and a kama or short Turkish sword, which was in very fair preservation, the blade, though without a scabbard, having suffered but little from rust. Major Stuart took possession of this kama, and should any future traveller reach the summit of Mount Ararat he may, perhaps, find it on the highest point, where the Major stuck it arm-deep into the snow.

With respect to this cross, it may be asked why Abich planted it so far down from the summit, if, as he asserts, he and his party reached the highest point? It would have been easy to have found as secure a position anywhere up to 1000 feet higher.

About 9 o'clock A.M. our friends had the satisfaction of gaining the highest point of the mountain, and with hearts brimful of loyalty, and somewhat elated by the occasion, they drank their Sovereign's health, as the fittest mode of giving expression to their feelings.

After spending nearly an hour on the summit, they addressed themselves to the somewhat nervous task of descending. The soles of their boots had been much worn away and smoothed by the ascent, but, by keeping to the tracks of the party that preceded them, and by the assistance of their faithful staves, they were enabled to tread their way in safety down the icy shoulder of the mountain. Arrived at that level where the snow is softer and more practicable, they abandoned the slow work of the feet, and, trusting to the glissade, they reached the foot of the cone about 12 o'clock. They had spent twenty hours in the regions of eternal snow, in the course of which, besides attaining the object of their expedition, they saw the sun set and rise with such glory and splendour as can be witnessed only from an elevation of 13,000 feet.

Pursuing their way towards the tents, they found horses awaiting them at the nearest practicable spot. The Kurdish messengers held their stirrups with profound reverence as they mounted, and as they approached the upper encampment, its occupants, old, young, and middle-aged, turned out to look on those strange English Beys, who, as they all had seen with their own eyes, had scaled the forbidden mountain. Milk of kine in all its forms was brought forth for their refreshment, and a sort of triumphal procession accompanied them nearly the whole way to the tent of Iss-hak Bey, where they arrived at 3 o'clock P.M. They were received by the Bey with many complimentary speeches, and after a cordial greeting from their "compagnons de voyage," the remainder of the afternoon was devoted to comparing notes. Dinner was served at sunset, and, as may be supposed, every resource of the encampment was put in requisition to make it as recherché as possible. The fattest sheep and the fattest kid had been slaughtered, for the Kurds know as well as the English that there is no way of honouring a guest more effectually than by a good dinner. Until a late hour the door of the tent was blocked up by Kurds, old and young, who were anxious to see with their eyes and hear with their ears the wonderful Beys of the mountain; for they no longer looked upon them as ordinary men, but as beings of a superior order, who could not be affected by the religious restrictions imposed upon themselves, and who were not subject to the physical infirmities of other men.

In now bidding adieu to the ancient mountain, we may observe that, owing to the suddenness and uncertainty of atmospheric changes on its higher levels, and the violent agitations of the elements about its summit, even at times when all is calm below, the only time of the year when it can be visited with safety is in the months of July and August, when, comparatively speaking, settled, fine weather usually prevails in these regions.

After a night of profound sleep, our party rose on the morning of the 15th, oblivious of fatigue and ready for any other enterprise that might be proposed. It was, therefore, carried by a majority of votes that that day should be devoted to the ascent of Lesser Ararat. Major Fraser and Mr. Thursby did not feel disposed to join in this expedition. Accordingly, after breakfast, the other three set out on horseback, accompanied by Iss-hak Bey and the zaptieh with two or three attendants on foot to take charge of our cattle. A rough ride of two hours over mountainous ground that had been torn up, scarred and distorted by old volcanic action, brought them to that part of Lesser Ararat situated above the saddle which unites the two mountains where horses are no longer available. Thence to the summit the perpendicular height is between 3000 and 4000 feet, and as the plane of the ascent is nearly even, and the surface, which is a loose gravel, affords a good foothold, they succeeded in reaching the highest point after about three hours' work.

The Lesser Ararat exhibits no traces of volcanic agency, but the effects of violent storms are visible in the nakedness of the rocks which crest the summit; all covering of clay or soil has been swept from them, and in many places they are vitrified on the surface and pierced with lightning-tubes, thus showing with what force electric storms prevail in these elevated regions.

The winter snows, with the exception of a few patches in sheltered places, are thawed on Lesser Ararat in the course of the summer, and on the occasion of which we are speaking, the air was as soft and still as it is on a May day in England. The summit, which appears from the plain to be a symmetrical finish to this beautifully-formed mountain, is concave, of irregular shape, and measures in the widest part about 60 paces. The concavity must at one period have formed nearly a complete shell; but on the south-west side nearly one-third of the rim has given way, following a land-slip which has formed a deep cleft extending many hundred feet down the mountain-side. The débris is now spread out over a considerable surface on the lower slopes.

The highest point of Lesser Ararat is a little rocky eminence that crowns the eastern flank. Here, within the compass of a few square yards, the three great empires of Russia, Turkey, and Persia come in contact. The boundary line between Turkey and Persia strikes thence nearly due south, that between Russia and Turkey due east, dividing the peak of greater Ararat, and thus securing one-half of the mountain to the empire of the Czar. There was a deep meaning in the policy which insisted upon the acquisition of a part of this mountain. It was not for the sake of the territory, for that is intrinsically valueless, nor had it reference to any military advantage, for the locality offers none; but it was in order to obtain a hold upon the religious feelings of the inhabitants of those countries, which, as we have endeavoured to show, attach themselves strongly to Mount Ararat. It was part of that policy which appropriated Utchmiadzin, the Rome of the Armenian Church, and the residence of its visible head—who thenceforward became a Russian subject.

The descent from the lesser mountain was easy and expeditious, indeed two of the party performed the greater part of it at a running pace, for the gravel yielding slightly at every step assists the descent while it prevents the possibility of a dangerous speed. Here, too, we started a family of the mountain ibex which was wandering about, Heaven knows in search of what, near the summit; perhaps they seek those places difficult of access in order to be removed as far as possible out of the reach of their enemies. The ascent of Lesser Ararat is but an ordinary feat, and is frequently performed by the young Kurds for a day's amusement; but as a pendant to what had been already done, it served to give a finish to the expedition. Of more importance, however, than this is the fact that from the summit of the lesser mountain, and perhaps from no other point, the spectator is enabled to judge of the vast dimensions and symmetrical form of the greater mountain. Seen from thence, all its irregularities of surface disappear, its whole outline is taken in from base to summit on the northern and southern sides, and the huge mass presents itself to the eye as regular in form as the great pyramid of Egypt, but far more beautiful in shape. We may also add that perhaps from no other eminence on earth is a vaster or more interesting view to be obtained. On a clear day the eye can range over the three empires of Russia, Turkey, and Persia, until the sight is fairly lost in distance. The panorama is bounded only by the power of vision.

Iss-hak Bey was in high spirits as the party rode back from the foot of the mountain to the tents. At times he would strike up one of the war-songs of his clan, exercising the full power of a voice, by no means unmusical, in giving effect to the wild and inspiriting notes. Inspired by his own performances, he would dash off at full speed whenever a suitable piece of ground offered, and, as if engaged with an enemy, go through all the evolutions of their peculiar mode of fighting, charging, retreating, wheeling short round as if on a pivot, shouting and yelling, until both man and horse seemed warmed up almost to the feelings of reality. The manœuvres were certainly very pretty to look at, and would, no doubt, tell well against such enemies as the Kurds have to deal with.

Early on the morning of the 16th preparations were commenced for the return to Bayazid. A breakfast in the highest style of Kurdish cooking was got ready betimes; milk, new and clotted, mutton, roast and boiled, and fresh chupaties in abundance, all hot and smoking from the embers; then came coffee and pipes, after which the zaptieh announced that all was in readiness. The cavalcade set out, headed, as usual, by the Bey, who was mounted on his favourite mare, equipped in all the finery of gay clothes and cumbrous arms. Retracing their previous steps, they descended the mountain, crossed the plain, and arrived at Bayazid about midday, when the whole party was again honoured with a reception by the Vaali. He congratulated the English gentlemen on their achievement, adding that it would be his duty to make a special report on the subject without delay to his Government. He probably attributed the expedition to some secret motives of policy or espionage, for the Turk is slow in believing that a man in the enjoyment of his senses will expose himself to difficulties and dangers from the mere love of adventure.

Be that, however, as it may, it is now registered among the State archives at Constantinople that in August, 1856, five English gentlemen succeeded in reaching the highest point of Mount Ararat.

PROCEEDINGS

OF

THE ROYAL GEOGRAPHICAL SOCIETY.

[PUBLISHED MARCH 23RD, 1877.]

SESSION 1876–77.

Fifth Meeting, 22*nd January*, 1877.

SIR RUTHERFORD ALCOCK, K.C.B., PRESIDENT, in the Chair.

PRESENTATION.—*Emil Brass, Esq.*

ELECTIONS.—*Reuben Vincent Barrow, Esq.; Rev. John Barton; Commander Lewis A. Beaumont,* R.N.; *Right Hon. Sir Richard Couch, Knt.; Godfrey Darbishire, Esq.; Rev. George De Vitre,* M.A.; *J. M. S. Fogo, Esq.* (Surgeon-General); *Bartle C. A. Frere, Esq.* (Lieut. Rifle Brigade); *R. William Galbraith, Esq.,* C.E.; *Abraham Goodall, Esq.,* M.D., &c.; *F. B. Halford, Esq.; Evan Herring Hare, Esq.; Commander R. P. Jenkins,* R.N.; *Sir J. J. Trevor Lawrence, Bart.,* M.P.; *Henry Lee, Esq.,* F.L.S., F.G.S., &c.; *F. G. Luck, Esq.; Capt. Colin Mackenzie; G. J. J. Mair, Esq.,* F.S.A.; *Charles Henry Marten, Esq.; Samuel Mendel, Esq.; Edward S. Morris, Esq.,* F.Z.S.; *William Irving Page, Esq.; Lieut.-Colonel George Massey Payne; Cecil Colvin Pitcairn, Esq.; Capt. William John E. Poole; Oswald Milton Prouse, Esq.; Fleetwood Sandeman, Esq.; Charles Seely, Jun., Esq.; E. Louis T. Smith, Esq.; Robert A. Sterndale, Esq.; W. E. M. Tomlinson, Esq.,* M.A.; *J. H. B. Warner, Esq.; Samuel Francis White, Esq.; Henry Francis Redhead Yorke, Esq.*

DONATIONS TO THE LIBRARY, JANUARY 8TH to 22ND, 1877.—Reise in Nordost Afrika, von Th. von Heuglin; 2 vols., Braunschweig, 1877 (*M^{me} Kieser, the deceased Author's sister*). Records of the Geological Survey of India, vol. ix., pt. 4, 1876 (*The Geological Survey*). Ostriches and Ostrich-farming, by Julius de Mosenthal and J. E. Harting, 1877 (*M. de Mosenthal*). Die Bedeutung Tripolitaniens als Ausgangspunkt für Entdeckungsreisende, von G. Rohlfs; Weimar, 1877 (*Author*). Spedizione nell' Africa Equatoriale de Conte Pietro di Brazzà-Savorgnan, di F. Nardi; Roma, 1876 (*Author*). South Australia. Statistical Register for 1875; Return by R. Hickson on navigability of Murray Mouth; Sections of Port Adelaide Creek, by Lieut. Goalen; Report by F. Howard on Australian coastline and ports; Improvement of Semaphore Harbour; Report from Public Works Department for 1875; and Return of Progress of S. Australia, 1870 to 1875; Giles's Explorations, 1875, and Journal of Mr. Lewis's Lake Eyre Expedition, 1874–5 (*The S. Australian Government*). Victoria. Statistical Register for 1875, part vii. (*The Victorian Government*). Tasmania. Mr. Sprent's Report on country round Mount Bischoff (*H.M. Sec. of State for Colonies*). The Ottoman Empire and its tributary states, by Capt. W. S. Cooke, 1876 (*H.M. Sec. of State for War*) Classification de 250 fécules, par — Bernardin; Gand, 1876 (*Author*). Hakluyt Society, vol. LIV. of publications; 2nd ed. of Barents's Voyages, by Lieut. Koolemans Beynen, 1876 (*The Hakluyt Society*). The Gold Regions of South-Eastern Africa, by the late Thomas Baines, 1877 (*R. White, Esq.*, F.R.G.S.). Annual Report of U.S. Geological and Geographical Survey of the Territories for 1874 (Colorado), by F. V. Hayden, Washington, 1876, and explorations made under direction of F. V. Hayden in 1876 (*Prof. F. V. Hayden*). Plan van een Onderzoekingstocht in Midden-Sumatra, door J. Schouw Santvoort; Amsterdam, 1876 (*Het Aardrijkskundig Genootschap*). Dun Echt Observatory Publications, vol. i., 1876 (*Lord Lindsay*). Across Africa, by V. L. Cameron; 2 vols., 1877 (*Author*); and the current issue of publications of corresponding Societies, Periodicals, &c.

DONATIONS TO MAP-ROOM FROM 8TH JANUARY TO 22ND JANUARY, 1877.—Submarine Telegraph map of the World, showing existing Telegraph Cables, December, 1876; by William Abbott; with a sheet of 'Analysis of the Submarine Telegraph Companies of the World, December, 1876' (*E. C. Rye, Esq.*). Newfoundland, by Alexander Murray, Esq., F.G.S. Two copies, one coloured geologically, the other showing the tracts fit for settlement and where pine exists (*Author*).

After the reading of the Minutes, Sir MORDAUNT WELLS said he wished to speak as to the correctness of the Minutes.

The PRESIDENT said if Sir Mordaunt Wells was going to speak to anything contained in the Minutes, the Meeting would be happy to hear him; otherwise he would be out of order.

Sir MORDAUNT WELLS said, with the greatest respect, it was not usual for the President to anticipate any observations that a speaker was about to make; and he was sure the greatest forbearance would be exercised towards him, when he said that since the last meeting he had received from all parts of England and Scotland an unparalleled number of letters, and did not on this occasion stand alone as merely representing his own opinions, but was now supported by a majority of the Fellows of the Society. At three o'clock that afternoon he had received from the Society what purported to be a Minute of their proceedings at the last meeting, and he wished to ask why the Minutes which had just been read differed from those which had been sent to him.* There must be some object in sending to a humble individual like himself a Minute of the proceedings, an honour which had never been conferred on him before. In all probability, if he had not received the Minutes he would not have been present this evening; but upon receiving them he felt it his duty, having taken action in the matter, to attend and again put a question with reference to the Minutes. Those who were acquainted with him knew full well that, having begun, he would never rest until the whole thing was investigated. He had received letters from officers of the highest distinction, and from scientific men, one and all complaining bitterly of the action of the officials. The course that had been pursued this evening had opened a door to him which could not be closed. The question must now be faced fairly; and, in the presence of the Council, he put the question why the Minutes sent to him differed from those which had just been read? Why should the Minutes have been sent to him more than to any other Fellow? The 'Times' and other newspapers reported most faithfully the proceedings of the last meeting, and those reports brought forth the extraordinary correspondence which had taken place between him and the other Fellows. The patronage to which he had referred had been exercised to an amount unheard of in the history of the Society. He was sure the President would do him the justice to say that his demeanour, when he rose on the previous occasion, was most respectful, knowing as he did the distinguished position which the President held quite apart from this Society; and it was in deference to that feeling, that he yielded to the decision of the Chair, even though the President himself afterwards entered into the question. If he had been discourteous enough, he might have taken advantage of that opportunity; but he had too much respect for the President and for the Society. But now how did the matter stand? The President represented a body of English gentlemen, in numbers and in point of education and standing unequalled by any Society in the kingdom, and it was these very gentlemen who complained of the action of the Council, and who, through him, said that on the occasion when the Arctic Expedition was discussed they were prevented from taking part in it, because the Hall was too crowded. The Arctic Expedition was mainly due to the action of this Society, yet the Fellows had never yet had an opportunity of discussing it. The arrangements were made altogether apart from the convenience of the Fellows. What must the outside world say when it was known that between 400 and 500 tickets were distributed independently of the Society? Could the Fellows, as a body of Englishmen, be expected to allow such a state of things to pass unnoticed? The tickets, too, were not given to illustrious men who were not members of the Society, but to those who carried opera-glasses, and, while Fellows of twenty years' standing were shut out, utter strangers, having no interest in geographical proceedings, were present to witness the parade that was then made. The character of the Royal Geographical Society was at stake. He was sure that no one could be more anxious than the President himself to have this matter sifted. He should therefore move that a Committee, consisting of not less than six Fellows of ten years' standing, should be appointed to investigate the whole matter in reference to the issue of those tickets; and that Committee would expect the officials to supply them with the history of the manner in which the tickets were distributed, and the orders that were received which ignored the Fellows of the Society. Unless that Committee was consented to, and unless the whole matter was thoroughly searched into, the great body of the Fellows would be greatly dissatisfied. He would do everything that was courteous and respectful towards the Council, and would frame his Resolution in any way that the Council thought most convenient for raising the question; but most probably he would be met with the ready concurrence of the Council. If it was so desired, he was quite willing that an equal number of the Council should act with the Committee, and that their proceedings should be presided over by the President of the Society.

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* This was merely a proof of Sir Mordaunt Wells' remarks at the former meeting, sent to him for correction for the 'Proceedings,' as required by the Regulations. The usual printed form accompanied the proof.—[ED.]

The PRESIDENT said, he thought he had given sufficient evidence that there was no desire whatever, either on his own part or on the part of the Council, to prevent any fair discussion of any subject that was interesting to the Fellows generally. Of course, certain forms and rules must be observed, otherwise it would be impossible to carry on the business of the Society, and Sir Mordaunt Wells had relieved him of any difficulty in the matter by not attempting to put his Motion now, but simply giving notice that he would move it at the next meeting. To that course he had no objection, and he did not imagine that the Council had any either. They would make their arrangements accordingly, and put the Motion on the agenda, to come on in its due course. He perfectly recognised the courtesy with which Sir M. Wells had pressed what he might conceive would be a disagreeable and unacceptable subject on the attention of the President and the Council, but the Council had nothing to conceal, nothing that they did not desire to be freely discussed. They were quite ready to adopt any rule or regulation that the majority of the Fellows might think best in reference to those rare occasions when a particularly interesting question was to be discussed. All visitors might be excluded, or the Fellows might ballot for tickets of admission for friends, always, however, taking into consideration the fact that 4000 people could not be put into a space that would only hold 2000 or 1000. The Council were the administrators of the affairs of the Society for the Fellows, and if they did not act in accordance with the wishes of the majority of the Fellows, the Anniversary Meeting in May would afford an opportunity for electing other members of Council and another President.

Sir MORDAUNT WELLS said he was desirous of consulting the convenience of the Council, and would bring forward his Motion at any time that was considered most suitable. He was perfectly willing to let it stand over till the Anniversary Meeting, if the Council thought such course the most convenient. Probably, therefore, the President would direct one of the Secretaries to inform him (Sir M. Wells) what the wish of the Council was in this respect.

The PRESIDENT said he was quite ready to meet Sir M. Wells in the same spirit, and if Sir M. Wells would send his notice of motion to the Secretaries in writing, it would be laid before the Council for action to be taken upon it. It would be inconvenient to bring it forward at the next meeting, as it was hoped on that occasion General Strachey would deliver the first of the series of lectures that had been arranged on Physical Geography; but the Council would either allow Sir M. Wells to choose an evening, or they might fix the motion for the Anniversary Meeting, when the Fellows would have an opportunity of electing another President and another Council, if they thought fit.

Sir M. WELLS said not one of the gentlemen who had written to him, nor he himself, had desired any such change.

The following Paper was then read:—

Recent Journeys in Madagascar: by JOSEPH MULLENS, D.D.

[ABRIDGMENT.]

DURING the past two years, among the journeys undertaken by English missionaries in Madagascar, five have been of unusual importance. They have been taken over entirely new ground; their results tend both to increase and render more definite the knowledge recently obtained of the interior of Madagascar. The following is a brief outline of each of these journeys:—

1. IKONGO IN SOUTH-EAST MADAGASCAR.

The Betsileo Province forms the southern portion of the central plateau; and on its eastern side it is bounded by the Great Forest and the southern extension of the broad terrace of Ankày. The forest is in two lines, and the scenery it presents is some of the finest in Madagascar. When Radáma—about 1820—after much obstinate fighting, conquered the Betsileo tribes, and so extended the Hova dominion towards the south, a portion of the forest tribes successfully resisted him. The Tánálas submitted, and in the fortress town of Ambohimànga the Princess Ráovana now rules as governor in the name of the queen. South of these Tánála lives a hardy branch of the same tribe, the Ikongo, who hold possession of an immense isolated hill. During Radáma's wars they sustained one siege of eighteen months, and subsequently another of twelve months; and in each case resisted with success. The Hovas have never set foot on the Ikongo hill; the Ikongo have a deep dislike to them, and they maintain their liberty and their isolation with great tenacity to this day.

Naturally this isolation cuts them off from the improvement which is now rapidly raising the Betsileo as well as the Hova tribes. The Betsileo Mission has been established only eight years, and its members have been anxious to gain access to the Ikongo people. After sending and receiving friendly messengers, on October 1st, 1874, Mr. G. A. Shaw, the Superintendent of the Normal School in Fianárantsoa, having received a definite invitation from the king of Ikongo, set out to pay him a visit. Passing Imhásóabé, he reached Morókona on the eastern edge of the plateau and entered the Great Forest. Of this Mr. Shaw says:—"This is certainly the thickest forest I have been into in Madagascar, and is one continuous mass of trees from Morókona (which we left about nine o'clock) till we emerged at Aviávy at five. In it we met no one, nor did we see a single house of any description, except just within the entrance at the south-east end of our route. I saw no animals but birds; though there were evident marks of great numbers of wild hogs, the turf having been torn up in many places by these animals in their search for grubs and roots. About half-way through this belt of forest a pair of mountains of strange shape rear their heads far above the surface of the plain. There is such a resemblance between the two that it would be difficult to distinguish one from the other. The northern side rises precipitously from the plain to the height of 1000 feet, the south and west sides are covered with thick brushwood. On the ridge between these two hills, over which we had to pass, we had a splendid view to the south-east. A deep valley lay before us, with the hills rising high on the opposite side, all densely covered with trees; and from near the summit of one of them a large stream came tumbling and roaring down into the valley."

After some caution and suspicion of Ratsiandráofana, the king of Ikongo, it was at length arranged that teachers should be sent to instruct his people. In June, 1865, Mr. Shaw took the teachers, and again visited the King and his people. Afterwards obtaining permission to travel by the southern road, so that he saw the whole Ikongo country. He says:—

"We slept at the entrance to the forest on Tuesday night. On Wednesday morning we found that, although the forest road was much shorter, it was very steep, and was almost one continual climb. On the top of one hill a break in the forest permits a view the most extensive, if not the most magnificent, I have ever seen. Being much higher than the fortress, this seemed at our feet; while for many, many miles the hills undulated away to the east, terminating in a white mist, which the guide said, was the sea. He informed us that on clear days the shimmer of the sun upon the water made it easily distinguishable. At about noon we were once more among the brown grass of the table land, and about ten miles from Ivohidroa, near which we stayed the night. The following night, long after dark, we arrived at home."

2. VISIT TO THE IBARA TRIBES.

The Ibára tribes were known to live on the south and south-west borders of the Betsileo Province. "Occasionally Betsileo and Hovas have found their way among them during these recent years of peace; but they have done so in peril; and not seldom have individuals from among the Ibára paid visits to the southern

Betsileo towns. Mr. Pillans and I saw such men in the town of Ambóhimandróso, and we could not but be struck by their rude appearance, their uncouth speech, and the lumps into which their hair was rolled. The English missionaries have gradually got acquainted with them; and the tribes have learned about the Englishmen that they were kind, could give medicine to the sick, and were anxious to teach people and make them wise. Occasions were taken for sending messages and little presents to the Ibára chiefs; and at length invitations were received asking the missionaries to pay them a visit. When the ground was sufficiently prepared, Messrs. Shaw and Riordan, on April 27th last, commenced their journey, and left Ambóhimandróso at the south end of the Betsileo Province to enter the Ibára territory. Travelling westward they crossed the ridge which bounds on the west the great rice-plain, and also the valley of the Tsimandao, and came on the border of the Ibára country at Tsi-áfa balála, a bold rock, 600 feet high, and nearly perpendicular on the south side. Next day they passed through the noble granite range, called Andringitra, of which Inváravárana ("the gateway") and Kipascha form conspicuous peaks; and were struck with the wonderful forms, the size and number, of the granite masses of which the ridge is composed. Apparently the range is like Ibety, the Váva Váto, and other masses of red granite, in the centre of the island. My colleague and I noted the serrated crest of this ridge during our visit; but it was too distant for close examination. Still going west and south through the well-watered valley of Isáhanámbo, they came to Bésikáona. They say of the country here:—

"Besikáona is situated at the entrance of an extensive and remarkably level tract of country, extending 30 or 40 miles south, and twice that distance east and west. This plain is somewhat higher than the plain of Tsi-ónim-paríhy, in which is situated Ambóhimandróso. It is crossed and re-crossed by a river, the Mènaráhaka, which rises to the east of the ridge east of Besikáona, and after traversing nearly the whole length of a valley in a western direction, turns south; then east to a point as far as its own sources." Mr. Shaw was told that the stream doubled on itself a second time: but Grandidier reports that near the foot of Ivohibe it cuts through the granite ridge, and becomes identified with the Mánanára. The point needs further inquiry. Going further west, through Ivily and Kivory, with their numerous cattle, Messrs. Shaw and Riordan came into the valley of the Central Ibára, with Ihósy as its chief town. They describe it thus:—

"Ihósy, a town of 220 houses, stands in the centre of an extensive valley, through which, from south to north, runs the River Ihosy, in its course to the Tsimandáo. This plain is enclosed with high hills, especially those on the west, where we noted two or three of considerable height. In several places the river spreads out into large lakes or marshes, partially covered with rushes and reeds, and forming the homes of large flocks of wild ducks and other wild fowl. As far as the eye can reach (a journey of a day and a half) north and south is an inhabited country containing about sixteen villages (towns they are called here), with from twelve to fifty houses. A king lives in one, Ipápainéna, to the south; and one at Ibetáninéna, to the north. Beyond this district to the south is a desert, uninhabited, between three and four days' journey in length. On the north is the same, for between one and two days' journey; and on the west over three days' journey; while on the east, though not strictly a wilderness, there are but very few inhabitants.

With a view to visit the Southern Ibára, our two travellers returned to the granite ridge of Andringitra, and near the north end of this ridge they seem to have found an extinct crater; in its hollow basin were four large and deep holes 14 feet across, with the bottom undistinguishable. Passing south, they came into the valley of the Ménaráhaka, which Mr. Shaw notices as a transverse valley, running across the island. From this point he went on to Ivohibe.

Ivohibe is one of the wonders of Southern Madagascar, and is well known to its scattered people. It is an enormous, isolated mountain, with a level top, standing in the centre of a broad plain, beyond and apparently below the Ménaráhaka Valley, and forming the next terrace toward the south. "In appearance and character it is like the fortress-rock of Ikongo, but its ascent is not so difficult. Like Ikongo, it has a lake of spring-water on its summit, which overflows and forms a considerable cascade on the northern side. This saved the native ruler and his people from defeat when they were besieged by the Hovas.

"In this plain I found the best population I have seen in the Ibara. The town I slept in, Ivòhimàrina, has fifty houses and a fair population. The town is the market for the Hovas, beyond which they are not allowed to pass without special permission of the king of Iantsàntsana, the tribe inhabiting this part of the country. There are six or eight other villages within half a day's journey, mostly on the banks of the river (the Mènaràhaka). The Ibara country extends nearly three days' journey farther south, but there is only a sparse population; it is called a desert, having villages along the route at distances of about half a day's journey apart. The general appearance of the south country is flat, with a few isolated hills here and there; but the general level is about the same as that of the Betsileo.

"There was quite an excitement in the town when I arrived. Guns were fired, and the people came rushing out *en masse* to see the Englishman. Most of them had never been out of their own province, nor seen a white man. They stopped me at the gate to ask the usual questions about the health of Her Majesty, and they said that the town was mine. I could go and choose what house I liked, and take whatever I wanted. They found me a good house, and brought me and my bearers a plentiful supply of provisions, in the shape of an ox, a pig, fowls, rice, and manioc, together with firewood. Next morning the chiefs had assembled, and we informed them of the object of our coming."

3. SOUTH-EAST MADAGASCAR.

In June and July last, a visit was paid to South-East Madagascar by Messrs. Sibree and Street, who passed through the forest at a new point, and travelled over a great deal of new ground. Throughout the journey Mr. Sibree took careful observations, from which he has constructed a map of the route, and of the country along which he passed. This map has been embodied in the general map of Madagascar.

Messrs. Sibree and Street commenced the new portion of their journey at the south-east corner of the Betsileo Province, from the hill-town of Imáhazóny. In three hours they entered the forest, and travelled through it the entire day. They say:—

"Notwithstanding the danger of looking about, it was impossible to avoid admiring the luxuriance of the vegetation. Many of the trees were enormously high, and so buttressed round their trunks that they were of great girth at the ground. The tree-ferns seemed especially large, with an unusual number of fronds; and the creeper bamboo festooned the large trees with its delicate pinnate leaves. It soon became evident that we were descending, and that pretty rapidly. For a considerable distance we had a stream on our left hand, which roared and foamed over a succession of rapids, going to the south-east; and every now and then we caught glimpses of the opening in the wood made by the stream, presenting lovely bits of forest scenery in tropical luxuriance.

"At half-past four we emerged from the forest, and came down by a steep slippery path through bush and jungle. And now there opened before us one of the grandest scenes that can be imagined.

The principal valley, down which we had come, opened into a great hollow or bay, three or four miles across, and more than twice as long, running into the higher level of the country from which we had descended. The hills, or rather edges of the upper level, rise steeply all round this great bay, covered with wood to their summits, which are from 2000 to 3000 feet above the valley. Between these bold headlands we could count four or five waterfalls, two of them falling in a long ribbon of foam several hundred feet down perpendicular faces of rock. Between the opening points of this valley could be seen a comparatively level undulating country with patches of wood, and the windings of the river Mátitánana. On a green hill on the north side of the valley stood a group of houses, which we were glad to hear was Ivóhitrósa. This hill we found was 700 feet above the stream at its foot. The Tànàla seem a very simple-hearted, kindly set of folks, and are most friendly. Our visitors were greatly interested in our watches, compasses, knives, pencils, &c., and quite entered into our wishes to get to know their words for various things. At this part of the island the high interior plateau seems to descend by one great step to the coast plains, rather than by two, as it does further north. The stream at the foot of this hill is only 500 or 600 feet above the sea; for we came down 2500 feet yesterday: and the two lines of forest which are crossed further north when going to the east have here united into one."

"*Saturday, June 17th.*—This morning we went down the hill on which the village is situated, crossed the stream, and ascended for some distance on the other side of the valley, in order to get a good view of the different gorges and their waterfalls. Mounting a spur of the main hills we had a good view of the chief fall up a deep valley to the south, and so opening into the main valley as not to be visible from Ivóhitrósa. This is certainly a magnificent fall of water. The valley is about a mile wide by two or three long; it ends in a semicircular wall of rock crowned by forest, and over this pours at one leap the River Mátitánana. Knowing the heights of some of the neighbouring hills, we judged that the fall could not be less than from 500 to 600 feet in depth. There is a large body of water, and from the foot rises a continual cloud of spray on either side, like smoke, with a roar which reverberates up the rocky sides of the valley. We were some three or four miles distant, but even from there it was a grand sight.

As they proceeded towards the coast, along the valley of the Mátitánana, they passed from the districts held by the Tánála, into those of the Taimóro tribes.

"The country all about here is delightful; there is a great deal of wood, but much open space; the hills are low and rounded in form; while behind us to the east is the lofty, deep blue, irregular outline of the higher plateau, with some prominent points towering above the rest. Among these, to the northward, a long hill was pointed out to us as the unconquered Ikongo.

"The direct distance from Ivohitrosa to the coast, as the crow flies, is not more than 45 miles. There is but one great step downwards from the upper interior plateau, and not two, as is the case further north. From 3000 feet high above the sea, a descent is rapidly made to between 600 and 700 feet; and then there is a long extent of undulating country, with low hills and patches of wood extending for 30 to 40 miles to the sea. The hills gradually decrease in height and the forest becomes thinner, until for the last few miles there is an almost bare and dead level."

At the Hova Fort of Ambóhipéno they stayed a few days, and Mr. Sibree took the opportunity to get bearings of the neighbouring villages. In the far distance to the west rose the long and lofty line of the interior plateau, but at no great distance from where we descended from it, it sinks abruptly to the plains; confirming Grandidier's statement that at about the latitude of 23° s. the elevated interior country ceases, and that from thence to the sea southward are low alluvial plains. There is, however, one break; at a few miles' distance from the termination of the plateau, there is a lofty detached mountain, Ivòhibé, which must be a magnificent object when seen from only a few miles' distance, as it is nearly as high as the elevated table-land. From thence there are only a few unimportant hills to break the level line which stretches out of sight far to the southward. On my way to and from the observing ground we passed great numbers and many varieties of butterflies in a few minutes' ride through the narrow lanes. Judging from this specimen, an entomologist would find a rich harvest in the Taimóro country.

"In the evening, when talking with the people, we were surprised to find that we were in one of the villages where the Arab influence is said to have been very strong in former times. The people here at Ivátomásina are called Zafin' Ibrahima (descendants of Abraham); and they say they are 'Jiosy mihitsy' (altogether Jews), and have many customs derived from the Jews. But what these were we could not ascertain; and there is certainly nothing in the appearance of the people, either in colour or features, to distinguish them from the majority of Malagasy. There is no doubt, however, that the Arabs have at some former time had a settlement here and on some other parts of this south-east coast, and to some small extent taught the use of Arabic letters. This probably gave rise to the statement in some old works on Madagascar that Malagasy was a dialect of Arabic. An intelligent young man, who came with the chief from Iváto, gave me a paper with all the Arabic characters and many of the syllabic sounds, with their equivalents in Malagasy. He also showed us a paper written by M. Grandidier in 1870, and given to him as a certificate that the bearer had copied for him various extracts from native Arabic books of prayers, genealogies, and sorcery; and that he (M. Grandidier) was well satisfied with his zeal and accuracy. We inquired about these books, but there seemed a good deal of unwillingness to let us know anything about them, or see them. The books of sorcery they said were burnt at the time of the burning of the idols in 1869."

From Ambóhipéno the party journeyed south with the view of visiting the Hova forts of Máhamánina, Ankárana, and Vangaindráno. "After passing (they say) through a narrow belt of wood, we came up to a ridge rising nearly 500 feet above the sea-level, a considerable height for this flat region. From this there was an extensive view; and on a prominent hill nearly due west was a conspicuous point, which the glass showed plainly to be a lofty steep-roofed *lapa*, with a good number of houses clustered round it. This was the Hova fort of Máhamánina, then about 12 or 14 miles distant. The town is wrongly placed on Grandidier's sketch-map of Madagascar; he shows it as about 40 miles nearly due south of Ambóhipéno, whereas it is really about 25 miles south-west by west. But as we heard he did not go further south than Ambóhipéno on this part of the coast, his information was probably derived from the natives, and was consequently vague and unreliable."

At Mahamánina (they say):—"From our house we have a pleasant and extensive prospect over a large extent of comparatively level country. We are now on the same parallel of latitude as Ivóhibé, the very lofty detached mountain to the south of the interior plateau. South of this, a very low line of somewhat higher land or hills than the general level of the Taimóro country seems to run for a considerable way to the south. To the south-west, at perhaps 20 miles distant, is a ridge of no great elevation, stretching north and south for a few miles; but beyond this nothing appears to break the low level line of the plain. The country to the west of Máhamánina is nearly bare of wood', but the main line of forest seems to run along the low country southward in the same general line that it follows on the edge of the upper plateau. Tribes of Tánála inhabit this forest region and its borders, as they do for 200 miles to the north of this, and there seems a considerable population of Taimóro to this place; I noted the bearings of at least twenty villages west of Máhamánina. The great mountain of Ivóhibó is about five days' journey from here, and around it are two tribes of Tánála, called Taivònona and Taisònja; of these a chief called Raibáhy, of a family named Zàfimanèlo, is king. The Hovas give a bad account of these Tánála, but the Taimóro told us there would be no difficulty in going amongst them. The tribe inhabiting this neighbourhood is called Zàfisòro.

"We ascertained that it was only a week's journey from Vangaindráno to Fort Dauphin; that there were villages and a large population all along the route; and that the Taisàka and Tanòsy tribes were friendly and acknowledged the Hova authority. Some, if not all of the people here, are a Sàkalàva colony from the west of the island, and are called Màsotáfika. For *eny* they say *eiky*; for *ity*, *itòky*; for *iry*, *iròky*, &c.

Having reached Vangaindráno, they observe:—"We were surprised at the large number of villages to be seen in every direction in this neighbourhood; they stand in groups of from two to half-a-dozen in a line and close together. It would be an interesting excursion to take a canoe and ascend the stream as far as it is navigable, which is for several days' journey, and so get into the interior of the southern portion of Madagascar, a district as yet perfectly unknown to Europeans, and probably to the Hovas as well. Except the Mangóro, the Mánanára is the largest river on the east coast, and rises far in the interior beyond the line of forest.* From all accounts there is a large population as one goes further west. Both to the south and north of Vangaindráno, the people seem to be divided into tribes who live on the banks of the different rivers, and who in many cases are called after the names of these rivers; while there is a tract of uninhabited land half-way between each considerable stream."

Throughout their journey, and on their return, they speak repeatedly of the kindness and hospitality with which they were welcomed by their native friends.

"In descending the hill I noticed that the villages in the neighbourhood of Ankárana were not so numerous as those surrounding the other three Hova forts in this part of the country; and the reason of this seemed plain: Ambóhipéno, Máhamánina, and Vangaindáno are situated in the valleys of considerable rivers, while Ankárana has evidently been selected on account of its strong situation, commanding a view of an extensive tract of country. Over a low range of hills to the west two prominent rounded mountains are seen; one of these, Isaonjo, it is said, occupied old Ràiningòry more than nine months in attempting to take it. He did not effect this, but eventually succeeded in setting fire to the town on its summit. On the top and slopes of Ankárana are large masses of volcanic rock."

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* Its upper portion is the *Mánaráhaka.*

At several points, on both the outward and the return journeys, Messrs. Sibree and Street observed masses of trap-rock, scoria, lava-streams, and the like; and it is evident that the volcanic eruptions so patent in the north and centre of the island have not been wanting in its southern districts.

"In three small ravines running down to the shore there were old lava-streams, some cut through by the action of water, and stretching out into the sea. Passing a village called Lòharàno, we presently came to an extensive lagoon, extending northward for four or five miles, and formed by the River Itampòlo, before it reaches the sea. This appeared to be the first (from the south) of that remarkable series of lagoons bordering the shore, and extending, with but few breaks, as far north as Hivòndrona, near Tamatave, a distance of 260 miles. Along the southern side of this lagoon are masses of lava-rock, some of it in enormous blocks."

Journeying along the sea-coast, at length they reached the Mananjára River, nearly a mile wide. "We got canoes and crossed at the bar; and so, after dark, reached Másindràno, on the northern bank of the river, and close to the sea. There is no town called Mananjára, but this Másindràno is the *ladóana* or port; while half a day's journey up the river is Itsìatòsika, the Hova fort, with a governor. This is the largest town we had seen since leaving Fianarántsóa. It has an air of neatness not very common in this country, and there are numbers of well-built houses standing in spacious court-yards. These belong mostly to French traders, of whom there are no fewer than forty residing here. A little way into the town we were met by the Commandant, with his officers, and the pastor, who gave us a kind welcome, and led us to a good-sized house."

From this point they ascended the river in canoes to Itsiátósika and beyond it; and passing Ambóditranámbo, and climbing the forest-covered walls, by Andákana and the Valley of the Mananjára, they at length reached Ambohimánga, the capital of the Northern Tánála, where they spent two days.

"These Northern Tánála, who acknowledged Ióvana as their chief, number about 6000, and extend from here to about three days' journey northwards. The situation of this town strikes one as exceedingly pleasant. A couple of hundred feet below, to the east and north, flows the River Mánandríana, and the surrounding hills on the further side of this stream are about the same height as the town, and are mostly covered with bamboo. Three or four miles to the west there seems to be a wide valley with bush and dwarf vegetation; but beyond this is a bold, prominent ridge, running nearly north and south, and dark with forest; while beyond, to the south-west, are lofty granite peaks in the far distance, at the edge of the table-land. Ambóhimánga is more than 2000 feet above the sea-level."

From this pleasant resting-place, the journey to the capital was easy. After a long climb from Ambódivóahangy, at the foot of a lofty hill, they reached Ivohitrámbo, 4750 feet above the sea, on the edge of the inner forest and plateau, and commanding a magnificent view on every side. Thence a few hours' run brought them to Isándrandáhy, on the high road between Antanánarívo and Fianárantsoa.

4. JOURNEY TO THE WESTERN SAKALAVAS.

Few parts of Madagascar are so little known as the western districts. All the east side of the island is under Hova dominion, and, being well supplied with rain, is covered with forests. At many ports on the coast French and English traders reside, and there is constant intercourse with the interior. Not so with the west. Here report has long spoken of a broad belt of no-man's-land, with hostile Sakalava tribes on the farther side. This unknown region has now been pierced by English travellers; the veil has been lifted, and we know what the land contains. A few paragraphs will suffice to exhibit the result.

A journey to the west was undertaken by Messrs. Sewell and Pickersgill, in June, 1875, being commenced from Máhatsinjo, four days' distance from Antanánarívo, and on the edge of the volcanic region near Lake Itásy. They say:

"We had travelled but a few hours west of Máhatsinjo before we lost all trace of human habitations, except here and there a few huts close to large cattle-folds, and a little further still, two military stations not far from each other. About a day's journey from Máhatsinjo we crossed the River Sakáy, which is about 100 yards broad, and though shallow when we crossed it, must contain a large body of water in the rainy season. This river may be regarded as the extreme western limit of Imerina; and between it and the Sakaláva lies an extensive tract of waste land, about six days' journey across. The greater part of this waste is covered with long grass, and cannot be much unlike the prairies of North America. Often the long grass on each side of the path grew quite over it, so that nothing of it was seen except the part on which we were treading, and often, too, the grass was quite above our heads when walking. Making way through this grass was very trying to the feet of our bearers, and a good deal delayed their progress.

"About two days' journey from Máhatsinjo we reached Tánimándry, a small military station on the banks of the Imánga. We had stayed to dine at another still smaller station, Tsinjoarívo, two hours before. Both these places, but especially Tsinjoarívo, made us feel very much for the poor people who were condemned to live there. They were immense cattle-pens, with a few houses connected with them; and the whole were surrounded by a thick fence of prickly pear.

"Antsiróamandídy took us by surprise; it is a large town for Madagascar, having from 150 to 200 houses in it. It is thoroughly isolated in the midst of the waste; but it is a stopping-place for almost all who travel between Imerina and those parts in the west which are subject to the Hova."

Starting from this point with provisions for four days, they say:

"At noon we reached another military station, Márovátana, as wretched as any we had seen. The houses there were the last we saw till, three days afterwards, we looked upon the plain in which Ankavándra is situated. In some parts of the extensive waste through which we travelled there are great numbers of wild cattle, and every dry season many of the natives (both Hóva and Sakaláva) are engaged in catching and taming them. On our return journey we met a party of about 200 men thus occupied. They came from the western part of our district, and it was interesting to be recognised by them as one who had preached in a village from which many of them came. On a few occasions we met with these wild cattle, but not often. Two or three times also we met with guinea-fowl, which started before us like partridges. The road all the way from Mahatsinjo had presented few objects of interest. The last morning's travel was somewhat exciting, as we drew near to the western limit of our journey and saw glimpses now and then of the broad plain in which Ankavándra lies. The descent into this plain was very steep. The table-land on which we had been walking for several hours appeared by our aneroids to be on an average about 2500 feet above the level of the sea; but after we had descended the hill and come to the stream at its foot, they pointed to only 400 feet above the sea-level.

"The River Mánambólo that flows past the town is a really fine river, and as we might suppose from the low level of the plain, there is but one slight impediment to the passage of boats up the river from the sea to Ankavándra. This impediment is about a day's journey to the west of Ankavándra, where the river finds its exit from the plain through the high hills on the western side of it. The proper name of Ankavándra is Miádanarívo, Ankavándra being the name of a river which runs close to it, and from which its supply of water is obtained. The town contains probably as large a Hova population as Antsiróamandídy, with perhaps an equal number of Sákaláva living in its immediate vicinity.

"We set off to Andránonandríana (another military station a short day's journey north of Ankavándra) on Saturday morning. Shortly after leaving the town we crossed the Mánambólo. It was at least 150 yards across, and there was another 100 yards of sand which is covered in the rainy season. The journey was a delightful one. The road was tolerably level, leading us often through park-like scenery very similar to parts of the road between Tamatave and Andovoranto. The grass, however, had none of the freshness of that in the east of Madagascar. The country here, and I imagine all west of the hilly country of Mándridráno and Vákinankáratra, seems to be quite free from the drizzly rains so common in the east during the winter, and this has a great effect on the character of the vegetation. The little streams coming down from the high land to the east were all skirted with trees, of which a great number were oleanders, and a still greater number were various kinds of acacias. The tamarind-trees, however, attracted my attention more than any others by their rich foliage, their beautiful form, and the grateful shade they furnished. I measured one that covered a circle of about 30 yards in diameter, and there were many whose branches extended over a space of 20 yards in width.

"On Wednesday morning we left Ankavándra and commenced our journey south to Imánandáza. The country during the first day's journey was very similar to that on the road to Andránonandríana, except perhaps that we saw more Sákaláva villages. But the second and third days and the first part of the fourth were more wearisome, both to us and our men, than any other portion of our journey from first to last. I should suppose that the plain of

Ankavándra is about 20 miles across, but there runs along the middle of it a range of very low hills, which seem mostly comprised of sand, with large numbers of quartz and other pebbles rounded by the action of water, and the whole thinly covered with short grass. What had been the previous state of this wide plain, and under what circumstances the water had acted upon these pebbles (we could not see the slightest trace of shells or former animal life) we often tried to imagine, but could come to no conclusions; but the effect of the pebbles on the feet of our men was unmistakable, and two weary days we spent in getting over them. Not that the whole journey was a wilderness. We crossed a large river, the Itondy, which forms a very important branch of the Mánambólo, and this was surrounded by luxuriant vegetation; and at the close of the second day's journey from Ankavándra, just as the sun was setting and whilst still near this river, we were for a while quite at a loss to know how we were to get through the tall prickly reeds, which, with a small but deep stream of water, seemed effectually to stop our progress."

After another weary journey over the stony plain, and continued struggle with the reeds and nettles, they reached Imánandáza. The river they found 150 feet lower than the Mánambólo at Ankavándra; but the town is on a low hill, and on the same level as the latter.

"On Monday we ascended a hill to the south of the town, that we might be able to see the large river which runs to the west about a day's journey to the south. All the rivers from the Sakáy, a long way to the north of Itasy, to the Manía, a large river which flows through the country of the Betsileo, unite in one great river about 30 miles to the south-west of Imánandáza. After the junction of the Sakáy with the Kitsámby there is a very fine waterfall or remarkable rapids, almost due south of Imánandáza. We had a great desire to go and see the falls, but it would have kept us at least three days longer on our journey. The river there is called Tsiáfadréharéha, and these rapids must always present insuperable obstacles to the navigation of the river further into the interior; but from that point to the coast, probably about 80 miles, there seems to be no impediment. All the natives who spoke of this river seemed to think that there was none other like it for width and depth in Madagascar. From the waterfall to its junction with the Manía it is called the Mahajilo, after that it is the Tsiribíhina (the river that cannot be forded). At the mouth of the river is the large town of Tsimánandrafózana, where a French trader, who goes among the natives by the name of

Samanta, has established himself. Judging by the reports of the natives, and by his being known in all the country round, he must be carrying on a large trade. Many Arabs also live there, and Mahometans from the islands north of Madagascar. We met one of these, who had come up the river in a canoe as far as he could on the way to Imánandáza, and was going about among the Sákaláva selling his goods. He assured us that no slaves were brought to Tsimánandrafózana.

From this point a long and wearisome journey of four days, through troublesome grass and under a hot sun, brought them again to the Mandridráno, from whence they had set out.

5. THROUGH THE ANATIVOLO TO SIHANAKA WEST.

A fifth journey was undertaken in June last, in an entirely different direction, by Messrs. Moss and Lord. These gentlemen proceeded to the northward, to a point not hitherto visited by Englishmen; and then, turning east, entered the Sihánaka Province on its west side. They also passed over much new ground, and have added valuable contributions to our previous knowledge of Northern Madagascar.

They first visited the Anátivolo, which was carefully mapped by the Rev. J. Sibree two years ago; and rested at Anósibré, at which town the Governor resides. The people of the district are known as Olo-máinty (black people); they resemble the Sihánaka tribes, and their tradition is that their forefathers were brought hither, during his wars, by Impóinimérina, some ninety years ago. The Anátivolo marks the first great fall in the ground on the north side of the central plateau. "The high ground which forms its southern boundary is, in fact, the northern termination of the great Imerina plateau, which, farther north-east, ends at Ambàravàrambàto, and east at Angàvo. The Anátivolo plain, shut in east, west, and south by lofty hills, extends northward, with alternations of low and rising ground, at a mean elevation of from 3000 to 2300 feet above the sea, as far as Ambòdiamòntana, five days' journey away. Along the whole extent of this large district, the soil is of sandy alluvium and red porous clay, easily disintegrated by the action of wind and rain. In many places on our journey we saw whole hill-sides that had been eaten and washed away by the tropical torrents, forming precipices of sometimes 1000 feet in depth, and chasms in whose shelter luxuriant forest-trees find a congenial habitat, and in which frequently large herds of cattle are fenced off and protected from the winter-cold. The tending of cattle on a somewhat larger scale, and the cultivation of rice, sugar-cane, and mángaházo (manioc), on a somewhat small scale, form the chief occupations of the people."

Passing over the rough clay hills to Andràopásika, crossing the Mánanara River, close to a conspicuous wooded hill called Vohiléna; and resting at the stations of Andránomiántra and Tsárahá-fatra, which Grandidier has placed on his map, they encamped at the foot of one of the great hills of the northern districts, the hill of Vóambóhitra. Mr. Moss says: "Its magnificent, black, basaltic mass had been visible for several days, and now towered grandly some 2000 feet above the plain. Arrived at its foot, we had a good view of this noble mountain. Its northern front appeared to extend about four miles, presenting a bluff precipitous face of black basaltic rock. It rises about 2000 feet from the valley, and its summit can scarcely be less than 4500 feet above the sea. Its general appearance resembles Table Mountain at the Cape of Good Hope. For three days at least, on our further northern journey, it was still the most conspicuous landmark, and we afterwards kept it in view for several days longer on our eastward course to Ampàrafàravòla and Ambàtondrazàka."

At Móraféno, a few miles beyond Vóambóhitra, they encamped on the banks of the Bétsibóka, here become a considerable river. Passing Ambódiamóntana, one of Grandidier's stations, they ascended an isolated moor, some 4500 feet above the sea, and the next day reached the important Hova fort and garrison of Antòngodrahòja.

"Antòngodrahòja is 'beautiful for situation.' It stands on the very verge of the high table-land over which we had been travelling for the last two days. About 4150 feet above the sea, it commands a most magnificent view of the broad valley of the Ikiòpa, the Bètsibòka, the Amparihibi, and the Màhajàmba on the north, as far as Trabònjy. From Antòngodrahòja the ground descends by a precipitous path some 2000 or more feet to the plain below; after which a good road leads by easy stages, three days' journey to Trabònjy, and thence to Mòjangà." Close to it, on the east, is the peak of Námakia, under which the pass into the plain runs. From its position on the old high road to Mojangá, and at the edge of the central plateau, it is a place of considerable importance. Its people are unusually intelligent, and far more advanced than the occupants of other towns on the route. And the rustling of silk dresses, and the display of French hats in the little settlement church, were associated with a fair knowledge of the latest hymns, and a most hospitable and kindly welcome to the friends who had come to instruct them."

In passing from Antòngodrahòja to the Sibánaka country, the travellers retraced their steps to Tánifótsy, and then went eastward. And it is a fact to be noted, that on the road they kept ascending and then descending, crossing hollows and ridges alterternately, showing that they were on the northern edge of the plateau, and that the sandy clay had been washed out from between the rocky ridges on which it rests. The population on the route they found to be Sihánaka, proving that this empty district had received its small supply, not from the centre of the island, but from the coast. Their ignorance was lamentable in the extreme. In the village of Antsámpandráno, the little population of 200 people, including several soldiers, were terrified at the sight of two live Englishmen, and at once ran away.

At Ampárafávóla they rested with the fine old Governor, an excellent man in every way, and then prepared to cross the Alàotra Lake. Between 8 and 9 P.M., they landed at Antànibáo.

Other journeys have been undertaken within the province of Imérina by Mr. W. Johnson; and a large amount of new detail has been gathered by him for rendering the map of the province more exact. Mr. Johnson has visited and examined the great hill of Ambohimiangára; the north and west sides of Lake Itasy; and the valleys of Ankáratra. He also succeeded in ascending four of the principal peaks of Ankáratra, the highest of which he judged to be 8763 feet above the sea. The extreme care with which Mr. Johnson observed, imparts to his suggestions and corrections a special value.

CONCLUSIONS.

The conclusions to which the facts gathered on these several journeys point may be thus briefly summed up:—

1. Since much new ground has been visited, considerable additions have been made to our knowledge of the geography of Madagascar. At several points the area of exact knowledge has been extended with correctness and care. Where vast chains of hills once met the eye, or a broad barren desert stretched out before us, and we could only long for new opportunities of finding what lay beyond,—now the ridges have been crossed, and the country behind explored; the desert has been passed, and the low country beyond has been duly surveyed. In this way the Ibára country, the Sakaláva districts on the west, and the Hova territory on the south-east, have been described. The forest has been crossed; important points, like Ivóhibé, the valleys of the Matitánana, Mananjara, and Mánanára, the course of the Mania, Vohambóhitra, and the Anátivólo, have been successfully determined. A new edition of the Madagascar Map has become necessary.

2. We know with greater exactness the boundary-line of the great upheaval, which has given us a raised plateau in the centre of the island with a basis of primitive rock, and a coast platform surrounding it on almost all sides. The gneiss ridge of Bóngo Lava, which marks very decidedly the western edge of the plateau, is more clearly known. The point where the two granite walls, which uphold the terraces on the east side of the island, coalesce and become one, is better defined. The northern lip of the same formation, with its high moor, has also been again visited.

3. The broad terrace of red sandy clay which surrounds the granite centre on all sides, and forms an outer terrace, about 800 feet lower than the central plateau, has been more fully examined, and its unfertile character been better understood. Here, too, as on the upper plateau, the effects of denudation, especially by the ordinary agents of rain, storms, streams, floods, and waterspouts, may be seen on an enormous scale. It is to be noticed also that, as the granite walls on the east are lofty and little broken, except along the terrace of Ankáy, this denudation has been thrown to the west and north, where the Betsibóka and Ikópa river (on the north and north-west), and the Mania, Tsiribihina, and Mánjóky (on the west), gather into themselves streams of water, which rise even on the very edge of the eastern granite itself. One thing of interest remains to be examined. No traveller has yet visited those localities in which these important rivers leap over the outer edge of the granite core of the island on to the lowest terrace which extends to the sea-shore.

4. The volcanic eruptions which were known to have been widespread, are now seen to have spread more widely still: and their results are traceable on the south-east coast, in the Ibára country and in Voambóhitra. Few countries in the world, of so limited an area as Madagascar, bear witness to volcanic action so enormous as this.

No addition has recently been made to our knowledge of the secondary formations in the district around the coast.

5. In all the districts examined, the estimate previously formed of the population has had to be seriously reduced. Whether among the Tánála, the Ibára, or the Sakalávas, the population has been found to be very thin; vast areas of territory are seen to be almost empty. But another thing has also been witnessed. There is in all directions an earnest desire for improvement. Wherever the English teacher goes, his visit is welcomed; his words of counsel infuse new life; his books are purchased; his assistant teachers are asked for. Little progress has been made in regard to roads,

and the conveniences of civilisation are not eagerly sought after. Time is wanted for right ideas to blossom and bring forth fruit. But the vision of the future is bright: its interpretation is sure.

[The Paper will be published entire in the 'Journal,' vol. xlvii.]

The Rev. J. PILLANS said all the movements of civilisation and progress in Madagascar had spread from the centre, and the value of what was taking place in the island would depend very much on what was going on in Antanànarivo, the capital city, which had a population of about 80,000. That city was to Madagascar even more than what Paris was to France. All kinds of movements began there and spread throughout the country. The great centre of life at present was in the mountains, the capital being situated on a hill 4500 feet high, surrounded by a plain at a level of 4000 feet. It had been supposed by some persons that as civilisation progressed the centre of life might change, and come down to the great plains and seaports. He was glad to be able to say that education, with which the great modern movement in Madagascar began, continued to spread wherever the Hovas' influence was felt. Year by year this work of education was being helped forward, and on the whole the people were receiving the efforts of the Government and the missionaries very kindly. It was only natural that they should do so, for the inhabitants of the remote districts, such as those which had been described in the Paper, had heard of what had taken place in the capital, and, apart from any appreciation of any great and high results from it of an intellectual and moral character, they saw that it had an elevating effect socially and industrially. Wherever teachers went they found that, partly from curiosity and partly from higher motives, the people were ready to welcome them; and it would seem that the Hova Government were now in a fair way of knitting the whole island into one strong people; there were, however, many obstacles in the way of rapid growth. As far as circumstances permitted, the Hovas and the Betsileo people were industrious, and worked hard in their rice-fields; but a great many things prevented the growth of their industry. There were no roads through the island, and even in the capital itself the roads were of the rudest description. There was thus no means of transporting their produce from one district to another. Besides this, there were no beasts of burden except a few scores of Mauritius ponies and a few bullocks and donkeys. The ponies only carried a few of the higher classes. There was thus no opportunity for the development of industry. If there were, the people would very soon show great progress, for they were keen traders and had a passion for money-getting. Up to the present time the Government had been afraid that outsiders were very eager to get possession of the country, and they had refrained from making roads so that any army coming from the coast might find transport very difficult; it was even said that, formerly, there was an easier route to the east coast than that in use now. When suggestions on this matter were made to some connected with the Government, their reply was, "We are too much occupied with house-building just now; we cannot begin road-making till it is finished." In 1873-4 the capital was being almost rebuilt. The old houses were of three kinds; rush houses, mud houses, and wooden houses. These were being replaced by houses of a very superior style. The system of labour, too, was opposed to any very rapid advance in the industrial development of the country. In 1817 the slave-trade was legally put an end to; but in the dark days of persecution the treaty was set aside, and it was not till 1865 that the slave-trade was again made illegal. Slavery, however, still prevailed, and it was a common thing to see twenty or thirty slaves for sale in the market. As a rule, they were kindly treated; but the system prevented the growth of industry. When he was at the capital, the woman who kept his house was a slave. One day she came to him in great trouble. It was a usual thing for the slaves to hire themselves out, and give half their wages to their masters; but in this case the master had sent to say he must have more than half the wages, because the Court having adopted European dress, he found the change very expensive. Year by year, as the slaves became better educated, their condition became worse. Very lately there was quite a blaze of feeling throughout the country, a rumour having spread that Queen Victoria was about to land in Madagascar with a British army, to set all the slaves free. But even if the slaves were set free one by one, they would be liable to public service, and the life of a soldier was as hard as that of a slave. In one or two ways the people might be helped by foreigners. The country was not particularly rich either in its fauna or its flora. Their chief culture was rice, but they were in want of crops that would grow in the upper parts of the country. Then, they had no sheep. They had a species of sheep with short hair instead of wool. but if they could get sheep whose wool would supply them with clothing, it would be a great boon to the people in the cold highlands. He did not think that the country itself was very tempting to capitalists, and the Government were rather jealous of such people.

Sir BARTLE FRERE said he had only seen Madagascar at two or three points on the north-west coast, chiefly at Mojunga and Nossibé; but all present would agree that very few subjects of greater interest had been presented to the Geographical Society than that to which they had just listened, regarding the great changes which had been wrought in Madagascar since it was first opened to Europeans by the exertions of the missionary Ellis and his brethren and successors. In the days of Marco Polo, Madagascar occupied a very large part of the attention of travellers in the East. From what was stated by Colonel Yule in his excellent notes to 'Marco Polo,' it was clear that the Arabs of those days had a great deal of intercourse with the coast of Madagascar; and he believed Dr. Mullens was of opinion that there was some foundation for the tradition that that Arab intercourse had existed from the days of the early Phœnician traders. Such tales as those of the enormous roc, whose feathers were 30 feet long, had their origin in the stories brought home by Arab travellers from the Madagascar coast. Why this intercourse was interrupted so completely was one of the curious problems of history, which, no doubt, some of Dr. Mullens' friends would in time elucidate. Apparently from the date of the commencement of European domination in the neighbouring seas, Madagascar declined in civilisation; but when, about the beginning of the present century, interest was again attracted to the country by a Scotch gentleman, who first induced the missionaries to go there, a slow awakening again commenced, and of late years it had been accelerated in a most extraordinary manner. When it was remembered that a written European character had been given to the language, that books had been printed in the native language, that the country had been opened up to missionaries, that the governing classes had been brought over to the side of Christianity, and that European travellers could now safely pass through all parts of the island, it must be acknowledged that a tolerably good piece of work had been done in one generation. Indian traders had again begun to resort to the coasts. At Mojunga he found as many as forty houses belonging to Mohammedan traders of Indian origin, and having their head-quarters in India. In this way the country was being penetrated in every direction, and it offered one of the most tempting fields for discovery that were now open. Naturalists would there be rewarded by finding the remains of animals now extinct, and the flora was also very interesting. A great part of the island was still a blank as far as the map was concerned, and discoveries might possibly yet be made as great as those which had rewarded the exertions of the missionary travellers. He hoped that, among other channels for doing good, the missionaries would not forget to prosecute geographical investigations, in which they had already so successfully laboured.

The PRESIDENT, in conclusion, said the Paper had deeply interested him, as showing how geographical exploration led by a natural and simple process to the introduction of Christianity and civilisation. That was the legitimate course of things, and it was most gratifying to hear how kindly and well disposed the natives were. They even exceeded the old Castilian Hidalgo's hospitality, when the whole house was placed at the disposal of a visitor, for in Madagascar the natives said to strangers, "The whole town is yours," and they provided everything that was required. He should be very sorry to think that the old influences that used to prevail in Madagascar would ever turn the kindly blood of these people into the viciousness that had been developed elsewhere. Certainly the progress made in the present generation was most encouraging and gratifying. The desire of the people for improvement was one of the most hopeful symptoms. No doubt it was rather unpleasant walking into a village with thirty leeches adhering to the foot; but, after all, the village itself appeared to be a pleasant place, and visitors had a pleasant reception. The Paper showed how much might be done when a right course was adopted, and when there was a continuous effort to carry the beneficial influences of civilisation, apart from its vices, into the midst of a simple and comparatively uncivilised people. There was no more encouraging example, in the whole course of missionary enterprise, than that presented in Madagascar, since, in 1816, Sir Robert Falconer, the then Governor of Mauritius, first attracted the attention of England to the island as a promising field for missionary exertion.

Sixth Meeting, 12th February, 1877.

SIR RUTHERFORD ALCOCK, K.C.B., PRESIDENT, in the Chair.

PRESENTATION.—*J. P. Joaquim, Esq.*

ELECTIONS.— - *Boyd, Esq.* M.D.; *E. A. Brown, Esq.*; *Rev. G. Brown*; *Charles Napoléon de Cardi, Esq.*; *John F. Corscaden, Esq.*; *Jno. Findlay, Esq.*; *Richard Frewen, Esq.*; *Walter Green, Esq.*; *Albert Grey, Esq.*, B.A.; *Henry C. Robarts, Esq.*; *E. P. Vacher, Esq.*

DONATIONS TO THE LIBRARY, FROM 22ND JANUARY TO 12TH FEBRUARY, 1877.—Reports to the Kaitakushi by Horace Capron: Tokei, 1875 (*Colonisation Department, Japan, per H.M. Sec. of State for Foreign Affairs*). Palestine Exploration Fund, Quarterly Statement, Jan. 1877 (*The Society*). La Suisse à l'Exposition de Géographie de Paris, par H. de Saussure; Genève, 1876 (*Author*). Serpent and Siva Worship, by Hyde Clarke, 1876 (*Author*). Analytical Report upon Indian Dialects spoken in Southern California, &c., by A. S. Gatschet; Washington, 1876 (*Author*). On Russian Proverbs, by J. Long, 1876 (*Author*). Gazetteer of the Central Provinces of India, 2nd edn., by C. Grant, Nagpur, 1870, and Eastern Persia, an account of the Journeys of the Persian Boundary Commission, 2 vols., 1876 (*H.M. Secretary of State for India*). Die Pflanzenwelt Norwegens (Specieller Theil), von F. C. Schübeler; Christiania, 1875; Windrosen des südlichen Norwegens, von C. de Seue, Kristiania, 1876; and Études sur les mouvements de l'Atmosphère (Pt. 1), par C. M. Guldberg et H. Mohn, Christiania, 1876 (*The Royal Norwegian University*). Norske Turistforenings Arbog for 1874 and 1875, and Reisekaart over Norges 5 Sydlige Stifter, Kristiania, 1873 (*The Norwegian Tourists' Club*). Aarböger for Nordisk Oldkyndighed og Historie for 1875 and Hefte 1 and 2 of 1876, and Tillæg til Aarböger, 1874 (*The Northern Antiquarian Society*). Trading Life in Western and Central Africa, by J. Whitford; Liverpool, 1877 (*Author*). Notices of Principal Manufactures of the West of Scotland, Catalogue of Western Scottish Fossils, and Notes on the Fauna and Flora of the West of Scotland, 3 vols., Glasgow, 1876 (*The Glasgow Local Committee of the British Association*). Geography, by G. Grove, 1877 (*Author*). Essay on New South Wales, by G. H. Reid, Sydney, 1876 (*The New South Wales Government, per Messrs. Trübner*). And the current issue of publications of corresponding Societies, periodicals, &c.

DONATIONS TO THE MAP-ROOM FROM 22ND JANUARY TO 12TH FEBRUARY, 1877.—Eighteen sheets of Tracings of the Nile from Ripon Falls to Khartum, including the Albert Nyanza, and between Khartum and Berber, on various scales (*Col. Gordon-Pasha*). Fifty-one sheets of the various Government Surveys of India (*H.M. Secretary of State for India*). Map illustrating Commander V. L. Cameron's Route across Africa, by W. J. Turner; London, Daldy and Isbister, 1877 (*W. J. Turner*). Kingdom of Bavaria, by C. F. Hammer. Nurnberg; Friedrich Campe, 1838 (*J. B. Johnston, Esq.*) Parts 14, 15, 16 of Spruner's Atlas of Medieval Geography; Gotha, Justus Perthes, 1876 (*Publisher*). Photographic Relief-map of the Yellowstone National Park, by W. H. Holmes. U. S. Geological and Geographical Survey of the Territories (*Prof. F. V. Hayden, U. S. Geologist*).

The Minutes of the previous meeting were read and confirmed.

The Secretary (Mr. CLEMENTS R. MARKHAM) read the following Resolutions, of which Sir M. Wells had given notice of his intention to move at the meeting of the Society on the 26th instant:—

"That a Committee of six Fellows of not less than ten years' standing be appointed to investigate the circumstances relating to the issue of visitors' tickets, to whom, and by whom, such tickets were granted on the occasion of the Meeting of the Royal Geographical Society, at St. James's Hall, on Tuesday, the 12th day of December, and the authority for the same.

"That the officers of the Society be requested by the Council to furnish the Committee with such information as the Committee may deem necessary and advisable.

"That the following Fellows be appointed to act as Members of the Committee :—

Sir ALEXANDER ARMSTRONG, K.C.B. and F.R.S.,
Colonel H. F. AINSLIE,
Professor M. C. VINCENT,
Sir MORDAUNT WELLS,

together with two Fellows of the same standing, to be nominated by the Council.

"That the President be invited to preside over the proceedings of the Committee.

"That three members of the above Committee shall constitute a quorum, and that the Committee be empowered to report the result of their proceedings at the Meeting of the Society to be held on the 12th of March, 1877.

"That the Meetings of the Committtee be held at the office of the Royal Geographical Society, 1, Savile Row."

The following Minute of Council was also read :—

"Notice of the Resolutions to be moved by Sir Mordaunt Wells having been considered by the Council, it is ordered that the following Minute be attached thereto and read before the Meeting of this date :—

"The Council regret that on certain occasions of more than ordinary interest, Fellows of the Society have been unable to obtain seats.

"As the number entitled to be present of Fellows and visitors exceeds in the aggregate six thousand persons, it is obvious that some inconvenience and disappointment are unavoidable under any circumstances.

"It has also hitherto been the custom in this, as in other Societies, sanctioned by precedent and allowed by the courtesy of the Fellows, to set apart some space for the accommodation of the Council—their invited guests and distinguished visitors.

"In view of the above facts, the only question is, whether any alteration can be made in the Rules of the Society or in the practice hitherto observed on great occasions, which may, without injury to the best interests of the Society, tend to remove any complaints on behalf of the Members. Such a question the Council are the first to acknowledge is a proper subject for investigation by a Committee.

"The Council, then, propose that a Committee should be appointed, consisting of an equal number of members of the Council and of Fellows of over ten years' standing, to be selected from the general body, the President of the Society being the Chairman ex-officio. The duty of the Committee will be to inquire into the working of the existent rules and practice and to report thereon, with liberty to recommend for the approval of a General Meeting any new Rules or modifications in practice with a view to remove as far as possible all causes of complaint or dissatisfaction.

"The Council recommend the course above suggested in preference to that proposed by Sir Mordaunt Wells, as being one better calculated to preserve that harmony and good feeling between the members of the governing body and the Society which has hitherto subsisted; and which cannot be disturbed without seriously endangering, not only the present interest, but even the very existence of the Society.

"Retrospective action and inquiry can only be useful in so far as it may lead to the removal in the future of any just causes of dissatisfaction or complaint. In so far as it secures this end, and is the only object sought, the Council will feel it their duty to give every facility and assistance, and will rejoice if the result should be to relieve them of all further responsibility as to arrangements for the accommodation of Fellows and visitors, when meetings of more than ordinary interest attract numbers of such magnitude as to preclude the possibility of finding places in which every one can be seated to his own satisfaction."

Sir M. **WELLS** said that, in consequence of the unusual course which had been adopted by the Council, he wished to know exactly what was now the position of himself and those with whom he was acting. Was the Minute to be treated as an amendment by the Council to the Resolution which he had given notice of? He had been entirely taken by surprise by the course which the Council had adopted. He should certainly proceed with his Resolution, because the Minute gave the "go by" to what had already occurred. Those whom he represented were determined, as far as possible, to know by whom the patronage was exercised at the meeting at St. James's Hall, and before they consented to any amendment by the Council, or to any alteration of the Rules for the future, they would insist upon a full explanation of the past. He therefore insisted on knowing distinctly whether the Minute was to be regarded as a proposed amendment, or whether his Resolution was to stand by itself for the consideration of the Fellows. He had never before heard of a minute being appended to a resolution before the resolution had been submitted to a General Meeting.

The **PRESIDENT** said that, on the notice of motion being brought before them, the Council conceived that, inasmuch as Sir M. Wells had on two separate occasions publicly made a denunciatory sort of speech, impeaching the action of the Council, and the proposed Resolutions were also couched so as to convey some kind of condemnation, it was their duty not to let three such public announcements of a prejudicial character go forth to the world without stating distinctly what their course of action would be. If it was desired to have a Committee of Investigation composed of equal numbers of Members of Council and outside Fellows, and presided over by the President—a suggestion which Sir M. Wells had at the last meeting expressed himself perfectly satisfied with,—the Council were quite ready to meet him on that ground. They would invite the most thorough inquiry into all their policy in reference to the admission of visitors; but as Sir M. Wells was not now prepared to accept such a committee as he had approved of at the previous meeting, there was only one frank and straightforward course for the Council to adopt, namely, to call a special General Meeting, according to the Rules, to consider and discuss Sir M. Wells' Resolutions. The Fellows would then have an opportunity of deciding whether or not they would grant such a committee as was now proposed, and of pronouncing an opinion upon the policy which had hitherto been followed by successive Councils in reference to the admission of visitors, both at ordinary meetings and on extraordinary occasions, on a full and fair view of all the circumstances to which that policy had to be applied. The Council had provoked and invited no discussion: they had simply thought it their duty, after three public denunciations of their action, to append a minute of the course which they were prepared to follow.

The following Lecture was then delivered by the Author:—

Introductory Lecture on Scientific Geography. By Lieut.-General R. STRACHEY, R.E., F.R.S.

IN June last the Council of this Society determined to offer increased encouragement to the extension in a scientific direction of the Geographical work which the Society is designed to promote, and it was resolved that, amongst other means to this end, not less than three of the ordinary evening meetings should be devoted to the delivery of Lectures on Physical Geography in its several branches, and on other truly scientific aspects of Geography in relation to its past history, or to the influences of geographical conditions on the human race. It has further been thought desirable by the Council that this, the first of those Lectures, should be of an introductory nature; that it should indicate the general scope of those that are to follow it, and thus supply, so far as your time and my ability will permit, an outline of the principal scientific aspects of Geography, to be filled in with more ample details by succeeding lecturers.

In accepting this task at the request of the Council, I have been very sensible of the extreme difficulty of doing justice to it, and I must ask those among my hearers whose knowledge of the matters of which I shall have to speak exceeds my own, to view leniently any errors into which I may fall, or any want of due proportion that in their better judgment may be found in my treatment of the wide range of subjects over which a review of scientific Geography will necessarily lead me.

Science, whether applied to Geography or any other matter, is, in truth, nothing more than well-arranged knowledge, and its methods though first developed by the study of abstract quantity and of the physical forces of nature, are applicable to all the objects of our senses and the subjects of our thoughts. The foundation of all knowledge is the direct observation of facts, in which condition it is termed empirical; the conclusions obtained by the application of thought to the facts thus observed constitute science, which by a process of classification and comparison seeks for the causes of which observed phenomena are the results.

The comparatively late application of strictly scientific method to Geography was a necessary consequence of the conditions under which the facts it deals with have been acquired. Geography is that branch of study which has for its object a knowledge of the earth. In its earliest shape it viewed the earth almost exclusively as the habitation of man. The inquiries it made concerned the distribution of the land and water, the positions of the continents, islands, and seas, and of the plains, mountains, and rivers; the manner in which the land was divided into various countries, and occupied by various nations; the divisions of countries into provinces, and the situation of the chief cities; and it took note of many other matters concerning the language, customs, and modes of government, as well as of the climate and products of all the countries found on the earth. As travel extended and knowledge advanced, the earlier impressions of travellers as to the striking differences between distant countries were supplemented by the perception of co-existing similarities. Attention was drawn to the peculiarities which persistently characterise, at places widely separated, the great regions of cold and heat, the mountains and plains, the coasts and interior of the continents; to the local and periodical variations of temperature and climate, and of seasons of wind and rain, over certain areas of land and sea; and to the distribution of the principal branches of the human race and of the families of plants and animals. A large stock of facts of different classes was thus accumulated. But before these observations could be viewed as a connected whole, or the true significance of their mutual relation could be properly appreciated, it was necessary that considerable progress should have been made in many special branches of physical knowledge. The ancient sciences of mathematics and astronomy had first to receive the enormous additions which followed the revival of learning in the sixteenth century. The modern sciences of chemistry and physics, biology the science which was born yesterday, and geology the science which was born to-day, had all to throw their light on the facts which scientific navigation had brought together from every sea and land, before that conception could be formed of the close inter-dependence of all we see upon the earth, which renders possible a true science of Geography.

For the aim of this branch of science is to ascertain by what agencies and by what process the earth has acquired its existing forms and characteristics. And this inquiry appears to establish that the phenomena observed on the surface of our planet are in their chief features attributable,—first, to the action of the great physical forces, attraction and heat, controlled by the earth's figure and its movements on its axis and round the sun; and, secondly, to the configuration of the surface, and the distribution of sea and of low and high land: and moreover, that all the phenomena of animate as well as inanimate nature have been in the past, as they still are, governed and determined by these same forces and influences.

We further learn that the figure itself of the earth, and the outlines of its surface, have been due to the former condition of the planet, and to the gradual changes it has undergone in cooling from a previous much higher temperature; that these and other causes have operated through a past into the obscure distance of which our vision cannot pierce, and are still at work, producing changes of surface, from which, as direct consequences, arise modifications of climate, and corresponding variations in the forms and distribution of living creatures, vegetable and animal. In this manner has been evolved the face of nature as we now see it; nature, which working with never-varying forces through ever-varying forms, appears to man in the present as his type of stability, while leading from the hidden shapes of an impenetrable past to those of an unknown future.

It is evident that the original investigation of the causes of terrestrial phenomena requires a knowledge of physical science, both wide and deep. But though this be true, it puts no serious difficulty in the way of imparting a thoroughly sound knowledge of the results, when once attained, to those whom want of leisure and perhaps of ability, prevents from going more deeply into these subjects. Nor need such a knowledge as is thus gained be either superficial or of small value; in the words of John Mill, "to have a general knowledge of a subject is to know only its leading truths, but to know these thoroughly, so as to have a true conception of the subject in its great features;" and it is hardly needful to insist on the advantage of having true conceptions in place of false or none, of such familiar objects as those which Physical Geography deals with. I therefore ask you, without hesitation, to discard all objections to including scientific geography in the course of an ordinary education, which are founded on the variety and complexity of the subjects it includes. These objections have, in truth, their origin in the too general absence of scientific knowledge which characterises a generation that has not itself received even an elementary education in physical science; standing in the same position with regard to these matters, as men who can neither read nor write stand in to the world of letters. It is one of the special functions of associations such as the Geographical Society, to aid in removing obstacles like these from the way of improved education: our Society may justly claim some pre-eminence in the steps it has already taken in this direction; and I feel satisfied that your intelligent support will be given to its steady progress in the same course.'

In proceeding to present to you, in a succinct form, a connected view of the principal matters that fall within the range of scientific Geography, I shall first touch upon those that more closely depend on the figure and movements of the earth viewed as a whole, and afterwards pass on to those in which the influence of local conditions becomes more marked; the former, speaking generally, affect more immediately inorganic, and the latter, organic matter.

The intimate relation between geography and astronomy is at once suggested by the essential importance to the geographer of a knowledge of the methods of determining the magnitude and true form of the earth, and of ascertaining position on its surface. It is of the highest interest to contemplate how man, with no other aid than his wonderful reasoning faculty, deduced from observations of the apparent motions of those heavenly bodies from which an impassable gulf divides him, the exact figure and dimensions of the globe on which he stands, of which he had as yet seen but a very small part; and how he extended this knowledge to the magnitude, the distances, and the laws that regulate the movements, of the whole planetary system to which the earth belongs.

Leaving the obscure origin of conceptions on these subjects to be sought for in Babylonia or Egypt, it is to Greece that we turn to find the first definite scientific opinions. Thales of Miletus, 640 years before the Christian era, already taught that the earth was a sphere. To his successor, Anaximander, is attributed the invention of maps; and his disciple, Pythagoras, suggested the true doctrine of the revolution of the earth on its axis and round the sun, though this conception dropped out of sight for centuries.

Eratosthenes, of the Greek school of Alexandria, in the third century before Christ, is said to have first determined the magnitude of the earth, adopting for the purpose the principle still in use.

Hipparchus, of the same school, who lived a century later, was the greatest of the Greek astronomers, and his additions to the science were truly remarkable. He discovered the procession of the Equinoxes, or the periodical change of direction of the earth's axis from east to west, in the opposite direction to its motion in its orbit; and the eccentricity of the sun's apparent orbit, the inequality of its motion, and its distance from the earth. To him is due the system of fixing geographical position by means of latitude and longitude, and the method of calculating longitudes from eclipses of the moon.

Ptolemy, about 150 A.D., was the last eminent man of this school. He collected all determinations of latitude and longitude of known places, and laid the foundation for correct methods of projection for geographical maps or charts. He is better known, however, by his treatise on Astronomy, which long continued to be the great authority on such subjects, and which caused his name to be given to the conceptions of the solar system it contained, though these were really due to his predecessors.

From this time until the sixteenth century—a space of 1400 years—no additions of any importance were made to this science. The study was revived in the ninth century among the Arabs, by whom the treatise of Ptolemy was translated into Arabic; and it was mainly through the teaching of the schools established by the Mahometans in Spain, and thence transmitted to Italy, that the knowledge already acquired was retained, and eventually so vastly extended. It was a little after 1500 A.D. that Copernicus put forth the view, this time to be finally accepted, that the earth and planets move round the sun. The almost simultaneous discoveries at the commencement of the seventeenth century of Galileo and Kepler, completed and corroborated this theory, and so opened the way for that explanation of the whole series of astronomical phenomena by the operation of the law of universal attraction, which is due to the genius of Newton.

A great impulse was given to precise geographical knowledge by the invention of the telescope and the pendulum, and their application to astronomical and geodetic observations. These led immediately to more exact determinations of the figure and dimensions of the earth. The measurement of an arc of the meridian in 1669, by Picard, gave Newton the means of verifying his theory of gravitation, and led to the recognition of the earth's ellipticity, as well as of the variation of the force of gravity at the surface with change of latitude, indicated by the varying time of vibration of a pendulum. Nothing then remained to be done in this direction but by the employment of better methods in detail, and of improved instrumental appliances, to attain results of greater accuracy.

Methods of calculating latitude, and instruments suitable for applying these methods, were comparatively soon devised. The difficulty of determining longitude was far greater, nor could it be overcome until correct clocks were constructed. The use of chronometers, the discovery of the telescope, and the progress of mechanical art, which produced instruments capable of measuring angular distances with accuracy, created scientific navigation. The practical application of this science has in our time opened out ways to the most distant parts of the globe, along which the skilful mariner passes in complete security at a speed which now makes every part of the habitable seaboard, however remote, more accessible than were many places in our own islands hardly a century back. To produce such practical triumphs the accurate representation of the surface by maps or charts was essential. The reproduction of the details of a spherical surface in a rigorously exact manner on a plane, such as a sheet of paper, being necessarily impossible, much ingenuity has been applied to devising the best methods for approximating to the truth. The exact measurement of the earth's dimensions, on which the accuracy of all delineations of the surface depends, is a task involving much difficulty, and calling for rare abilities in the geodetic surveyor.

And here let me dwell for a moment upon the very great practical value of those compendious contrivances for conveying information to the mind, diagrams and drawings, which are little, if at all, less valuable than written language. Their special power consists in bringing clearly within the reach of apprehension, at the same moment and in suitable juxtaposition, a great multitude of objects interdependent but different, and so producing an intelligent connected conception of the whole, often without effort, and always with a clearness that no verbal description could secure. I desire to invite particular attention to this subject, feeling assured of the utility of maps or illustrative diagrams in dealing with the many complicated phenomena that present themselves to the scientific student of Geography. A certain fair facility for making such maps or diagrams may be acquired as readily as writing. Man has long been distinguished from other animals by the faculty of speech, and Professor Huxley has lately reminded us that he is the only drawing animal. These faculties correspond with the "two ultimate modes by which it is possible to implant ideas apart from actual experience, viz., narrative and diagram;" * and he who possesses both tools doubles his power of obtaining and imparting knowledge.

Having thus traced the growth of our knowledge of the earth's figure, and the relation of geography to astronomy, I pass on to notice briefly the parallel onward course of geographical discovery.

Scarcely less admirable than the sagacity of the astronomers of the past, have been the enterprise and perseverance of that succession of able men who, by journeys over land and sea, have

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* I have taken these words from an Essay on Science and Language, by my friend Colonel Dickens, R.A.

furnished positive evidence that the earth is in fact the globe which man's reason had taught it to be, and who have brought together, in defiance alike of the rigours of the elements and the barbarous nature of uncivilised man, the ample stock of knowledge which we now possess of the entire surface of the earth.

Like astronomy, Geography originated in Egypt and Greece. The earliest geographical conceptions were necessarily based on ideas of position in relation to the locality where the ancient geographers lived and wrote, and upon these the gradually increasing knowledge of the civilised world was engrafted, and developed around the eastern end of the Mediterranean Sea. Herodotus, writing 450 years before the Christian era, may be taken as the exponent of the earlier forms of Greek geography. The junction of the Mediterranean with the Atlantic was then known; ideas of the North and West of Europe were vague; the form and position of the Caspian were fairly ascertained; the descriptions of India do not extend beyond the Upper Indus; and the coasts of Asia seem to have been unknown beyond the Persian Gulf. The circumnavigation of Africa is referred to, but it may be doubted whether this was more than mythical.

Alexander's expedition, 330 B.C., reached the Indus; some of the Greeks who accompanied him went into India Proper; while on his return Nearchus followed the coast from the Indus to the Persian Gulf.

Up to the Augustan age, the only additions to Geography were obtained through the Roman conquests in Western and Northern Europe. In the time of Pliny, the coasts of Asia had hardly been traced with certainty beyond the mouths of the Ganges, and only vague conceptions of China had been formed. These had become more defined, and extended to the Malay Peninsula, Sumatra, and Java, by the time of Ptolemy, A.D. 150.

Till the end of the twelfth century, the further progress of geographical, like that of all other branches of knowledge, was very inconsiderable. Something was done by the Arab geographers in the early period of the growth of Mahometan power, and something by Norwegian Vikings. But in the thirteenth and following centuries, when the civilisation of Europe was becoming consolidated, the spirit of enterprise was gradually awakened, and led to great results.

The institution of the orders of friars, the desire to spread Christianity, and the terror produced by the incursions of Jenghiz Khan into Eastern Europe, were followed by journeys, of which one of the most remarkable was that of the monk Rubruquis into Central Asia. The growth of commercial activity sent forth the

Polos on similar expeditions. The knowledge of Central and Eastern Asia thus obtained, formed almost the whole of our stock up to our own time.

The formation of the powerful republics of Venice and Genoa, and the spread of their commerce, under the stimulus of many causes of which the Crusades may be reckoned as one of the most prominent, led somewhat later to the development of maritime habits, knowledge, and enterprise, among the nations bordering the Mediterranean, which at length found their expression in the series of great voyages of discovery which are among the most remarkable events of the world's history.

The Portuguese, as the result of systematic and continued effort, reached and doubled the Cape of Good Hope, arriving on the coasts of Western India in 1497. Nearly at the same time Columbus, following a truly scientific course of induction, for the first time so applied by man, embarked on the celebrated voyage which led him to the West Indian Islands in 1492, and which was soon succeeded by those in which he reached the continent of South America, near the mouths of the Orinoco. Cabot rediscovered the coast of Newfoundland. In the first half of the sixteenth century, Magellan started on the voyage in which the circumnavigation of the globe was for the first time accomplished by a circuit round South America and through the Pacific. Cortez advanced into Mexico; Pizarro and others turned southward along the Pacific to Peru and Chili. The Portuguese gradually explored the southern coasts of Asia, reaching the Moluccas and southern China; and the coasts of Japan and northern China became known through the Portuguese pirates. The beginning of the seventeenth century supplied a knowledge of the coasts of Australia, the Dutch from their colonies in Java having sailed round the west and north coasts in 1627, and discovered, under Tasman, the south coast, New Zealand, and Van Diemen's Land.

Thus in a period of less than 150 years was acquired the knowledge of the main outlines of the great areas of land and sea, to complete which in more exact detail has been the task of succeeding generations.

The later voyages of the seventeenth century were undertaken chiefly by privateers and buccaneers, of whom Drake and Dampier were the chief. Towards its end began the expeditions specially despatched by various countries for purposes of scientific discovery; and second to none have been those sent out by England, beginning with Halley, including the voyages of Cook, and ending with those of Nares.

In our own time geographical exploration has been chiefly directed to the Arctic regions, and the interior of the great continents of Africa, Asia, and Australia; and it was in the earlier part of the present century that arose the conception of scientific geography, in connexion with which will ever be remembered the name of Alexander von Humboldt.

The study of Magnetism has an unusually close connexion with the progress of geographical research.

The general properties of the magnetic needle were known and applied to navigation in Europe as early as the tenth or eleventh century, but much earlier by the Chinese. The variation of the declination, or deviation of the needle from the true north, at different places, was probably known before the time of Columbus, but to him seems to be due the observation of the gradual change which takes place in sailing westward across the Atlantic, until a line of no variation is reached, beyond which the variation becomes easterly. The conception of the earth being a magnet is due to Gilbert, an Englishman, about 1600 A.D. Halley, about 1700 A.D., suggested the idea of four poles of magnetic force, to the influence of which the complicated movements of the needle might be referred.

The results of magnetic observation as now collected, establish that there are, in fact, four magnetic poles, and that the magnetic force exhibits a series of periodical variations, both in respect to its direction and its intensity, dependent on the time of day, of the year, and the succession of years, as well as on the place of observation. The variety and complexity of these phenomena are great, and they are regarded as the results of electrical currents, established at or near the earth's surface, and due in some unknown way to the earth's revolution on its axis and round the sun, and to the heat emitted by that body. The application of the study of magnetism to practical navigation in these days of iron ships becomes a matter of very great importance.

The impress of the movements and figure of the earth is everywhere seen underlying the almost infinite variety of phenomena brought to our knowledge by the more and more complete exploration of the surface. It is these which determine the amount of heat received from the sun at any part of the earth; and regulate the distribution of temperature on which immediately depends the distribution of life. Everywhere we find alternations of what I may term terrestrial work and rest, consequent on the daily and yearly movements of the globe, which, subject to the influences due to the spheroidal form of the earth and the direction of its axis of rotation, give rise to the varying length of days and of seasons at different places, and to a multitude of other recurring phenomena which characterise the animate and inanimate world. Day and night, summer and winter, active life and sleep, or hibernation, periodical winds diurnal or prolonged, seasons of rain and drought, are among the best known of these. The tides and the less well-known but equally regular periodical oscillating movements of the atmosphere obey the same general laws. A great number of other secondary phenomena carry out similar effects through all parts of the earth, and into all the operations of nature, both on the land and in the waters; for instance, in the currents of the ocean, the periodical rise and fall of rivers, the migrations of animals, the increase and decrease of disease among men.

Though many of the effects observed would equally follow as consequences of the sun moving round the earth as a centre, yet direct evidence that the converse is the case is to be found both in the movements of the atmosphere and in the currents of the ocean. The winds and waters, as they pass over the surface of the earth, acquire a velocity of revolution corresponding with the latitude, being greatest at the equator, and diminishing gradually towards the poles. The velocity thus acquired gives an eastward impulse to all air or ocean currents moving from the equator towards the poles, and an apparent westward impulse to air and water moving the other way. This has long been recognised as the true cause of the peculiar directions of trade-winds and monsoons; and more recently as the efficient agency in determining the direction of the south-west and north-east gales that characterise our own coasts. The revolving storms or cyclones which are among the most terrible of the natural adversaries of man, carry with them an awful testimony to the true direction of the earth's revolution on its axis from west to east.

As the facts which most directly depend on the form and movements of the earth became more completely known, and as the related conceptions arising from their study were more clearly developed, an inquiry naturally began into the nature of the earth's solid crust, and of the forces by the action of which the surface has received its existing outlines, elevations, and depressions. The science of Geology is the result; and the relation of this science with Geography is what we have next to consider.

A very little observation and thought threw discredit on the ancient cosmogonies, and showed that they failed to give any satisfactory solution of the problems submitted by the advance of geographical knowledge. If the extravagant myths of Asiatic origin, which peopled the earth millions of years ago with races of anthropomorphic demi-gods and heroes descended from the sun and moon, could not bear the test of facts; neither have those traditions fared much better which unveil the earth fully equipped with all the present forms of life, and specially prepared to be the dwelling-place of man no more than a few thousand years ago. Precise observation has now supplied satisfactory proof that the earth's surface, with all that is on it, has been evolved through countless ages, by a process of constant change. Those features that at first sight appear most permanent, yet in detail undergo perpetual modification, under the operation of forces which are inherent in the materials of which the earth is made up, or of those developed by its movements or by the loss or gain of its heat. Every mountain, however lofty, is being thrown down; every rock, however hard, is being worn away; and every sea, however deep, is being filled up. The destructive agencies of nature are in never-ceasing activity: the erosive and dissolving power of water in its various forms—the disintegrating forces of heat and cold—the chemical modification of substances—the mechanical effects produced by winds and other agencies—the operation of vegetable and animal organisms—and the arts and contrivances of man—combine in this warfare against what is. But untiring nature immediately builds up again that which it has just thrown down; hand in hand with this destruction, nay, as a part of it, there is everywhere to be found corresponding reconstruction. If continents disappear in one direction, they are rising into fresh existence in another. Though the ocean tears down the cliffs against which it beats, the earth takes its revenge by once more upheaving the ocean's bed. And thus the globe has passed in succession through an infinitude of anterior states, by small modifications extending over a vast period of time, but not differing in essentials from those which are now seen to be going on.

The far greater heat of the interior of our globe, which increases about 1° Fahr. for every 50 or 60 feet of depth, gives us conclusive evidence that it has reached its present condition from a former state of much higher temperature. As the exterior gradually cooled, contractions necessarily ensued with consequent change of form and dimensions; and to these, acting in combination with gravity, were due the disturbances of the earth's surface, which have caused its greater irregularities. The strains set up by these forces may have continued to cause movements for a vastly prolonged period, and are probably still in action. Recent speculation has suggested that even volcanic phenomena may be consequences of the heat developed by the intense pressures set up by the mechanical forces concerned in these movements of the cooled outer solid crust, and not results of the very high temperature which almost certainly still subsists at great depths in the interior.

In the absence of any direct means of ascertaining the condition of the earth's interior, aid has been sought from astronomical science, by which it has been established, that the thickness of the solid outer shell of the earth must be considerable; and that if the interior is in a fluid state at all, it must be covered by a great thickness (probably not less than several hundred miles) of solid, comparatively unyielding matter; and it is argued with apparent force that no connexion can exist, by which molten matter could pass between such depths and the surface.

As the mountain ranges are areas of elevation due to the pressures developed by the contractions of the surface, so the chief valleys commonly follow fissures along the lines of rupture; and their directions are determined by the lines of tension produced by the same mechanical strains which accompanied the elevations; mathematical science here, too, has come to the aid of geography and geology, in suggesting explanations of many characteristic directions of the elementary portions of mountain masses.

In the ocean we see the waters of the earth accumulated in the depressions formed on the surface in past time. The great continents occupy the areas that have risen in comparatively recent periods, and the clusters of islands probably indicate the remains of former continents now disappearing. We find in many directions evidences of movements on a very large scale, which lead to the conclusion that most of the existing great mountain chains have received their present prominent altitudes in almost the latest geological periods; and that during, or since those periods, the forms of the land and sea have greatly altered. Other indications, however, are not wanting, that some of the great features of land and sea, as we now find them, have been preserved for very long periods, and these may possibly be relics of the earliest forms taken by the surface soon after it attained a solid condition.

There was at first no little disinclination to accept theories which required vast periods of time in order to account for the observed facts of geology by forces now in operation. But these difficulties have at length disappeared, and with them the school that explained the great differences between the past and the present, by a series of catastrophes, or convulsions of nature, for which we have no authority in actual experience.

Should any difficulty arise in conceiving how such vast movements as those of which we see the results in mountains like the Himalaya or the Andes, and in the analogous depressions of the bed of the ocean, can have been produced by a mere secular change of the earth's temperature, I would remind you that the forces called into action by the earth are proportionate to its magnitude, and that its parts must be viewed in relation to that magnitude also. It has been calculated on sound data that the contraction of the diameter of the earth, consequent on the fall of temperature from a fluid state to its present condition, has been about 190 miles. At this rate a subsidence of 5 miles, which is the approximate greatest depth of the ocean, would correspond to a fall of temperature of about 200° Fahr. But the actual elevations and depressions of the surface have probably been produced by a comparatively much smaller loss of heat, being due rather to tangential strains than to any direct subsidence.

An illustration may assist you in forming a truer estimate of the irregularities of the earth's surface, which, though apparently great, are insignificant when viewed in relation to its actual dimensions. This hall might contain a globe 40 feet in diameter. If it represented the earth it would be on a scale of 1 foot to about 200 miles, and 1 inch would be equivalent to a distance of 16⅔ miles, or 88,000 feet. On such a globe the difference between the polar and equatorial diameters would be less than 1 inch, and the greatest elevations in Britain would rise to about the thickness of a threepenny bit. The highest mountains and the deepest seas would be shown by elevations and depressions of hardly more than ⅕ of an inch; and if they were distributed as such features are on the actual earth, they would be visible only with difficulty, and to your unaided eyes would in no way interfere with the apparent perfect smoothness of the globe's surface.

But the irregularities of the surface constitute only a small part of the effects of internal heat on the earth. Mineralogy is the branch of science which treats of the many simple and compound substances, that have issued under the operation of chemical forces from the vast laboratory contained within the cooling crust of the once incandescent globe. The spectroscope shows that the original materials of which all these substances are made up are the same as those that constitute the sun and other heavenly bodies, thus confirming the conjecture that all of these bodies are the results of the aggregation of matter once diffused in space. The waters of the ocean we must regard as a residual liquid product, resulting after those combinations were completed which supplied the solid parts of the earth. In like manner, the atmosphere is the residue of the gaseous matter, after all the requirements of the laws of affinity had been elsewhere complied with; and it is not a little remarkable that these two subsidiary collections of matter, as I may term them, the air and the sea, which constitute a mere film on the earth's surface, should exercise so predominant an influence on terrestrial economy.

The area of the dry land is very greatly exceeded by that which is covered with water. The whole surface of the earth being 196 millions of square miles, about 51 millions are land, and 145 millions water. The average height of the land above the sea-level is also very much less than the average depth of the sea-bottom below that level, so that a rearrangement of the surface is quite possible by which the whole of the land might be submerged with comparatively little disturbance of the present level of the sea, or reduction of its average depth.

The mobility of water, and its properties in relation to heat, more especially that of evaporation, make the ocean one of the most important elements of terrestrial existence; it furnishes to the atmosphere the moisture which is one of the essentials of life, and serves by the circulation of its waters to equalise greatly the temperature of the globe, moderating the extremes both of heat and cold. The greater or less proximity of the sea directly affects climate; and the relative position of land and sea areas frequently determines the directions of the prevailing winds, while the formation of the coasts, their directions, and the depth of the bottom, immediately affect the flow of oceanic currents, and the distribution of heat through their means. The position and magnitude of mountain-ranges have also often an indirect influence on these actions of the ocean; they lead to the discharge into it of great volumes of fresh water from rivers, whereby currents are originated or modified, and they cast on its surface those vast masses of floating ice, which carry the temperature of the polar regions with them, far into the temperate zone.

The application of mathematical reasoning to the complicated phenomena of the tides of the ocean offers a striking illustration of the success of such methods, and of their great practical utility. They have supplied the theoretical knowledge which enables us to calculate, after a comparatively short preliminary process of observation, the daily and hourly periods and extent of the rise and fall of the tides at any part of the ocean; thus meeting one of the great wants of the seaman. The attraction of the sun and of the moon directly tend to produce a tidal wave which shall follow the apparent place of the moon, moving from east to west, or in the opposite direction to that of the earth's revolution; but though this result is actually produced in the more open part of the ocean, yet the distribution of the great masses of land is such that the law can only very partially be complied with; in fact, in our own seas the tidal wave moves generally from west to east, or diametrically in the opposite direction to that of the force which generated it. This affords another of the numerous illustrations of how greatly local conditions of surface affect the operation of the great forces set up by nature.

Among the influences which give to the earth the characteristics that most immediately affect its fitness for occupation by man, those of the atmosphere are, without doubt, the most prominent. These influences, under the general designation of climate, are constantly affecting us. Of all branches of science, that which treats of the atmosphere—Meteorology—is at the present time certainly the most backward. The reasons are not far to seek. The air is invisible, and, for the most part, inaccessible. The changes it undergoes take place with great rapidity; they are difficult to observe, and, from their great complexity, difficult to grasp. It is pretty certain that the essential causes which operate on the atmosphere are changes of temperature; but the application of mathematical reasoning to the movements of elastic fluids when submitted to changes of temperature, is accompanied with great difficuties, and very little has been done to grapple with them. What we know then of these subjects is as yet almost exclusively empirical. Our instrumental appliances are here far in advance of our theories, and it is not to be disguised that great waste of labour too frequently results from an exaggerated refinement in observation, which has no real value.

The air, though highly attenuated, constitutes a fluid-medium beneath which the whole surface of the earth is immersed, and by which all that is on it is surrounded, supported, and penetrated. The air is the vehicle through which warmth and moisture, and the gaseous necessaries of life are supplied to all that is on the earth. With the ocean, the air performs the part of equalising temperature, and preventing excessive accumulations or losses of heat; and as the ocean supplies the source of moisture, so the air distributes it, first absorbing and then delivering it up at some distant place. The very great activity of the air in carrying out these functions is truly remarkable. If the whole quantity of moisture in the air at any moment were condensed so as to leave it absolutely dry, the resulting stratum of water, i distributed evenly over the whole earth, would be less than 1 inch in depth. Yet it is estimated that the mean rainfall over the whole globe is not less than 60 inches in the year, and falls of ten times this amount are known to occur in some localities. Actual observation of the velocity of the wind at marine stations, shows that such results may readily be due to the almost unceasing passage of saturated air over the regions where, and during the time in which, rain thus falls, and to the unceasing renewal of the supply of moisture by evaporation. The relatively very large total sea-area has an important effect in facilitating the supply of the rain that falls on the land; and the actual distribution over the earth both of heat and moisture is largely dependent on the local distribution of the land and ocean areas.

Our observation is almost necessarily limited to the lower regions of the air. But it is to be remembered that three-fourths of the air in weight is found within 30,000 feet, and nine-tenths of the watery vapour and half the air within 20,000 feet of the surface. Hence it is certain that the movements near the surface are those that chiefly affect all conditions of climate, though no doubt there are great movements in the upper regions to bring about the restoration of equilibrium, which is being constantly disturbed below.

The principal periodical winds—such as the trade winds, the monsoons, the land and sea breezes—are easily explained, and are found to be essentially dependent on periodical variations of atmospheric pressure, accompanying variations of temperature, due to geographical conditions. The proximate causes of the more characteristic winds of the north of Europe, and especially of our own islands, appear to be also well made out. They, too, are disturbances of pressure; the rapidity and intensity of which and the manner of their transfer from one area to another, determine the force of the wind, the direction in which it blows, and the manner in which it veers. But how the changes of pressure are produced, and what causes the transfer of the disturbed area in a definite direction (usually from west to east) we have still to learn; though here, too, it is obvious that the formation of the surface, the distribution of the land and sea areas, and of the ocean-currents, are among the principal agencies at work. The winds of our islands have commonly, more or less distinctly, the gyratory character which is one of the secondary results of the revolution of the earth. The precise conditions under which the great cyclones or hurricanes of the tropics are generated have still to be discovered, but we have a sufficient knowledge of the manner of their occurrence to enable the instructed mariner in most cases to escape their worst consequences. That these winds also are strictly due to local terrestrial influences cannot be doubted.

The action of the periodical winds in producing the seasons of rain in the tropical and semi-tropical regions of the earth, is of the greatest practical moment, the water-supply and the production of the ordinary food-crops being often wholly dependent on such rains; and the search of science into the controlling causes of their failure and abundance, may result in enabling us so to foresee the possible occurrence of drought as to guard against its worst consequences.

The immediate dependence of rainfall on local geographical features is too well known to call for more than a passing remark. The presence of mountains forming a barrier in the path of the vapour-bearing winds may determine, on the one side a climate of perpetual cloud and rain, and on the other vast tracts of desert. Where no mountains exist to cause condensation such winds pass on, leaving deserts behind them, and carry their waters to fertilise more distant lands.

A well-known consequence of the physical properties of the air becomes apparent under the influence of elevation of surface, in the gradual reduction of temperature observed as we ascend mountains. This amounting to 1° for about 300 feet of elevation, gradually produces a change of conditions similar to that caused by receding from the equator towards the poles; and at the greatest elevations an arctic climate is established even under a tropical sun.

The great ranges of mountains entering the regions of perpetual snow, which traverse the tropics or approach them, are among the sublimest of the sights furnished by nature. Here, by the intrusion of the solid terrestrial surface into the upper parts of the atmosphere, the low temperature, which otherwise could have produced no effect on the earth, is brought into active operation; and the results are carried down in the form of great rivers, which fed by the melting fields of ice, or the copious condensation of rain on the mountain slopes, fertilise the plains beneath as they pour forth their never-ceasing streams.

Whether in the shape of glaciers in their mountain beds, or as the floating fragments of glaciers that form icebergs, or when merely producing disintegration in the fissures of rocks, ice is one of the most energetic of destructive agents. The recurrence of glacial epochs with alternations of periods of greater heat, in the earth's past history, of which geology supplies apparent evidence, is of much interest, and has given rise to much speculation. Among possible causes of this are to be reckoned the variations of the form of the earth's orbit, which, combined with the changes of position of the axis in relation to the points of least and greatest distance from the sun, due to precession, appear capable of producing very considerable effects on the summer and winter temperatures of the two hemispheres, without affecting the mean temperature of the globe. Actual displacements of the earth's axis of rotation have also been suggested as a means of accounting for these great local changes of temperature; but the evidence in this direction has hardly yet been carried beyond arguments, based on mathematical reasoning, to show that such displacements are not incompatible with established facts.

A few words will indicate the magnitude of those forces which are called into silent and comparatively unobserved operation in the atmosphere by the sun's heat. It has, as I noticed, been estimated that on the average 5 feet of water falls annually as rain over the whole earth. If we suppose that the condensation takes place at an average height of 3000 feet above the surface, the force of evaporation must be equivalent to a power capable of lifting 5 feet of water over the whole surface of the globe 3000 feet during the year. This would involve lifting 322,000 millions of pounds of water 3000 feet in every minute, which would require about 300,000 million horse-power constantly in operation. This calculation does not include the force required for the transport of the rain in a horizontal direction. But such numbers cease to convey any precise signification, and I will therefore add, that the engines of the largest ironclad do not exceed 8000 or 9000 horse-power. Of the huge energies thus excited a very small part is transferred to the waters that run back through rivers to the sea, and a still smaller fraction is utilised by man in his water-mills. The rest is dissipated in tending to equalise the temperature of the celestial spaces and what is therein.

We have now seen how, under the action of inherent or external forces, the globe has been moulded to its present form, and has received the existing configuration of its surface; and how from these have resulted all local characteristics of climate, fitting it for the support of life. We thus find ourselves at the mysterious line which separates inorganic from organic matter.

Of the origin of life, either when or how it began, we know nothing; all that can be said is that the earlier conditions of the earth were altogether incompatible with life as we know it. For thousands of years, as the globe cooled down, its surface must have been deluged with boiling water; and until a temperature had been established not very greatly exceeding that of the present, none of the forms of life found in the oldest fossiliferous rocks could have subsisted. And life is restricted to a very thin stratum at the surface, hardly more than one thousandth part of the earth's diameter—the proportion of a coat of varnish to an ordinary globe.

The old received sharp distinction between animal and vegetable is quite broken down. The bond that subsists between things with and things without life, is testified by the identity of the elements of which they are all composed; the absence from the materials of which the earth is formed, of a single one of certain elementary substances, such as oxygen or carbon, would have rendered what we know as life wholly impossible. The only conclusion is that life is in its nature analogous to other properties, of whose connexion with matter we are equally ignorant; and that it is in fact in some unknown way a necessary adjunct or consequence of matter in certain conditions.

Scientific theories of life must be based on the study of the structure and distribution of existing plants and animals, and of the corresponding facts established by the aid of geology. These teach that all things having life exist in groups, such as vegetables and animals, mammals and birds, cats and dogs, and so forth; among which may be traced various degrees of structural affinity, gradually increasing, until we at length reach individuals known to be related by descent from a common ancestor. We also find that the assemblages of creatures in countries easily accessible to one another, and alike in climate, closely resemble one another; that as distances increase, and communication becomes less easy, and climate less similar, differences in forms of life are more marked; and that great distance and complete separation are generally accompanied by a total change of forms. Distance in geological time has the same effect as distance in space; the further we go back into the past, the more different were the forms of life from what they now are.

These were the phenomena to be accounted for. The problem was, whether or not this could be done by having recourse to the only means which direct observation shows to be capable of producing living creatures, propagation by generation through descent from parent to offspring. The answer has been given in the affirmative by Darwin, to whom we are indebted for a theory of life analogous in its breadth and the genius it displays to the great conceptions of Newton. Darwin has shown how propagation by descent, accompanied by certain small variations in the offspring, such as are known to occur, would be followed by the necessary preservation of some of the varieties to the exclusion of others, and how this would account for many of the facts observed, while inconsistent with none. To the preservation and destruction of forms by reason of favourable or unfavourable external conditions, he has applied the term Natural Selection. He has thus explained how it is that uniformity of conditions and facilities for diffusion over any area are found in connexion with similarity of forms of life throughout the area, and how any break of continuity of conditions, or surface, or time, involves differences in forms of life. Great tracts like northern Europe and Asia, extending along the same parallels of latitude, not broken up by high mountains, are biologically one. Great mountain ranges like the Himalaya, and great deserts, constitute impassable barriers. Isolated lands, like Australia, are almost wholly dissociated in their life from other countries. The same results are found in the seas. With the rapid variations of climate that occur on lofty mountains rising from tropical plains, are developed numerous forms of life; on those ranging through many degrees of latitude, as in the New World, there is greater variety of life, corresponding to greater variety of climate, than on those nearly following the same parallel as in the Old World. Extensive land areas appear requisite for the evolution and support of the larger forms of terrestrial life, while restricted areas are characterised by smaller forms and fewer of them.

The laws that govern the diffusion and limitation of vegetable and animal life are similar; but a satisfactory correlation has not yet been established between the geographical distribution of vegetables and animals. For, though some of the great natural provinces marked out on the earth's surface by characteristic assemblages of plants and animals, respectively, are more or less conterminous, this cannot be said to hold good as a rule.

Many apparent difficulties in accounting for the existing facts of distribution, are solved by a consideration of the many great changes that have taken place in the outlines of land and sea in past time. The data necessary for any complete solution of all the questions that arise are wanting, in consequence of our still very limited knowledge of the geology of many parts of the earth, and especially of extinct forms of life concealed beneath its surface. But every fresh fact discovered seems to strengthen the evidence of the actual occurrence of evolution, and of the general truth of Darwin's theory as to its essential factors.

The phenomena of which I have been speaking indicate much more than a simple conformity of life to the conditions under which it subsists; the conditions, in fact, have positively determined, and finally fixed, those forms that have been preserved, so that the general course of life, as it has been evolved in the past, is in essentials a mere sequel to the course of the material forms of the earth's surface.

Perfectly unbiassed evidence of the truth of this conclusion is found, in the tendency that had been shown before Darwin's great discoveries to give weight to geographical distribution in systematic classification. And though it be true that classification should rest wholly on morphological considerations, yet the structural likeness of forms geographically associated is often so complete, while so many links in the chain of evolution have been lost for ever, or still have to be found, that, on the one hand, distribution may without objection furnish collateral aid in the details of systematic arrangement, and, on the other, structural resemblances may serve to suggest changes of geographical conditions of which no other evidence remains.

The doctrine of dependence of life on external conditions includes life itself as an important concurrent agency in the general results observed. Thus, in order to supply the food and other requirements of animals, the presence of vegetables or other animals is necessary. To some animals, as well as to some plants, the shelter of forests or particular forms of vegetation is essential. Parasites need for their sustenance living plants and animals. The fertilisation and propagation of plants is very commonly due to insects; and the infrequency of certain forms of insect-life in some of the islands of the Pacific, is held by Wallace to be the true cause of the simultaneous infrequency of flowering-plants.

Nor is organic matter without a large reaction on the inorganic parts of the earth. The building up of coral-reefs; the laying out of extensive calcareous and siliceous deposits over the entire bed of the ocean; the action of vegetable life on the constituents of the atmosphere; the effects produced by vegetation in modifying the absorption and radiation of heat by the soil, and the conditions of moisture; afford instances of vital forces actively affecting the condition of the earth.

As life, viewed in one aspect, performs the function of sustaining life, so in another it works for destruction. It at once supplies food and the elements of decay. Among the latest results of science may be noticed those that trace epidemic diseases, with certainty among insects and plants, and with much probability among the higher animals, to parasitical organisms; and show how these withdraw the necessary elements of healthy existence, and may at length lead to the total dissolution of the creature in which they are produced. And, like the forces connected with inorganic matter, life also follows the same incessant round of construction and destruction; it elaborates from the earth new combinations of matter, and again dissolves them, to restore to the earth the elements on which its own renewal depends.

In what I have been saying of living creatures, I have not distinguished man, for in all such respects he cannot be separated from the rest of the animate world in which he holds the most conspicuous place. The monuments of Egypt, which take us back perhaps 7000 years from the present time, mark a very brief stage in that journey through which we have come down from our four-handed progenitors. The human race existed in company with many mammalia now extinct, at a time far distant, when the outlines of sea and land and the conditions of climate over large areas were greatly different from what they now are; and modern researches have done much to exhibit its gradual progress to the historical period.

Man, with his special faculties and dispositions, all of which have been developed under the pressure of external influences, is still as directly dependent, in most respects, on the physical characteristics of the regions in which he dwells, as any other of the beings that possess the attribute of life. If, on one side, his ingenuity enables him to avoid the agencies which to other less sagacious animals are irresistible, and teaches him how to wield them for his own purposes, yet on the other, in doing this he is forced more completely than any other creature to shape his existence so as to conform to their inexorable sway.

The arts of civilisation by which man secures advantages not to be obtained from the unaided forces of nature, have now transferred the chief seats of his power from the warmer latitudes where existence was in times past most easy, to colder climates where the conditions are more favourable to the continued exertion of his intelligence. Civilised man compels the earth to increase its vegetable and animal produce, for the supply of his growing numbers. He breaks into the store of minerals hid away below the surface and converts them into power. He makes the ocean a highway over which he rides to pursue his ends in all parts of the globe; and thus uses an obstacle impassable to most living things, as the principal means of his own migrations.

But geographical features will ever continue to determine the course of man's career, and to regulate his movements, be they directed by peaceful or warlike desires. History will always tell how nations have been born, have grown, and have perished, under the influence of causes that can be traced back to the material earth; and whether we call it mother country or fatherland, the soil under our feet, as in the Greek fable, is the true source from which we draw our bodily, mental, and social strength.

I shall close this review of the subjects comprised in scientific geography, which the forthcoming series of lectures, to which this is the prelude, are designed to illustrate, by briefly recalling the chief topics to which I have directed attention.

1. The figure and movements of the earth, and the progress of our knowledge of them.
2. The progress of geographical discovery, and its results.
3. Geographical methods, instruments, and maps.
4. The magnetism of the earth.
5. The ocean, its depths and circulation.
6. The tides of the ocean.
7. The dry land, continents and islands, mountains and plains.
8. The mineral constituents of the earth.
9. Volcanic action and the interior of the globe.
10. The atmosphere and the distribution of heat on the earth.
11. The winds and fall of rain.
12. Regions of ice and glaciers.
13. The distribution of vegetable and animal life in the present and past.
14. The races of men, and their dependence on geographical conditions.

These are the studies through which scientific geography will lead you, teaching you to view the earth in its entirety, bringing together the great variety of objects seen upon it, investigating their connexion, and explaining their causes; and so combining and harmonising the lessons of all the sciences which supply the keys to the secrets of Nature. Geographical knowledge may be aptly compared to the setting in which are gloriously held together the bright gems of science, to form an intellectual diadem for man. This study best supplies those wide fields of observation which are the true and only sources from which we draw our intelligence and originality; for the mind has no power of absolute production, but only of perception and comparison. It is the power of applying with rapidity and precision the thoughts suggested by external objects and their mutual relations, that constitutes originality and gives the means of invention. And this is as true of imagination as of reason. For by the influence and study of external nature are formed and developed man's emotional, intellectual, and moral faculties.

The emotions created by the vast extent of ocean, its ever-moving surface, the changing outlines of land and sea, the richness and luxuriance of the vegetable clothing of the earth, the astonishing variety of animal forms, the many diverse races of men, the never-ceasing transformations of the clouds as they float overhead, the play of light and colour over the whole of these objects, the firmament set with stars that bounds our vision and expands our conceptions when we gaze into the unknown depths of space, the large serenity of nature at rest, her overwhelming violence in convulsion—these emotions are the source of all our ideas of the beautiful and sublime.

The strong stimulus afforded to curiosity and observation by the varied scenes of nature, is the necessary antecedent of that ferment of the mind which precedes intellectual activity. Hence the constant succession of new objects which greets man as he changes his place on the globe, exciting in him an interest not awakened by scenes of long-continued familiarity, is one of the most active agencies in arousing his desire for knowledge, the acquisition of which, as it is among the few permanent springs of our own enjoyment, so constitutes our best or only means of adding to the well-being of others.

The contact with other living beings which is a direct result of geographical discovery, teaches us man's true place in nature; our intercourse with other races of men in other countries teaches us what is humanity, and gives those lessons of civilisation needed to overthrow the narrow prejudices of class, colour, and opinion, which bred in isolated societies, and nourished with the pride that springs from ignorance, have too often led to crimes the more lamentable because perpetrated by men capable of the most exalted virtue.

Let past experience be permitted to show us the one way to certain future progress, the way opened by the increase of true knowledge; let us complete that conquest over our globe which is so eloquently described by the poet, when he makes the earth on the setting free of Prometheus, the type of human intelligence, burst forth in a song of triumph over the destiny of man, her latest born:

> "The lightning is his slave; heaven's utmost deep
> Gives up her stars, and like a flock of sheep,
> They pass before his eyes, are numbered, and roll on.
> The tempest is his steed; he strides the air,
> And the abyss shouts from her depth laid bare,
> 'Heaven, hast thou secrets? man unveils me; I have none.'"

The PRESIDENT said they had listened to a lecture of the greatest interest, full of wise suggestions and instruction. In showing how enlarged was the scope of Geography, General Strachey had done good service. He had pointed out that mere descriptive geography was a very small portion of the great subject which the science embraced, and had thereby encouraged the Society to pursue the course of lectures which it had been thought desirable to begin. He was sure that all present would join in a sincere vote of thanks to General Strachey for his able and instructive address. Before the Meeting separated he wished to mention something which had only just come to the knowledge of the Council. The German Geographical Society at Berlin held a meeting on the 3rd instant, to hear an account of their travels from two successful African explorers who had just returned home—Dr. Lenz and Dr. Pogge. The latter gentleman had made a most remarkable journey, which would give him a high place in the list of African travellers. He had succeeded in penetrating from St. Paulo de Loanda to the capital of the renowned African potentate Muata Yanvo (or Yambo), a remote district which had hitherto never been reached by any explorer, and even but by few coloured Angolan traders. The capital, Musumbé, lay to the north of Kabebe, the seat of government of the preceding monarch, and many days' journey to the west and north of Cameron's line of march. Dr. Pogge travelled for the sake of pleasure as a hunter of the larger African game, and not as a scientific explorer; but some of the information he had obtained was of the highest interest, particularly as regards the healthiness and beauty of the interior plateau. He did not believe the Lualaba flowed into the Congo, but seemed to entertain no doubt that the Kasai or Cassabé was the upper course of the great river.

At the next meeting of this Society two interesting papers would be read—one by Lieutenant Young, who had just returned from Lake Nyassa, where a steamer had been launched and a settlement formed; and the other by Mr. Price, the adventurous missionary who hit upon the happy idea that a bullock-waggon road could be formed between the East Coast and Lake Tanganyika, and who had made an experimental journey with bullocks, and taken them to the upper highlands. He was now busy getting the most perfect bullock-cart that the manufacture in England could produce.

ADDITIONAL NOTICES.

(Printed by order of Council.)

1.—*Report on the Congress of Orientalists (Third Session) at St. Petersburg.* By Captain F. C. H. CLARKE, R.A., Delegate of the Royal Geographical Society at the Congress.

SIR, London, December 14, 1876.

As Delegate of the Royal Geographical Society to the Third Session of the International Congress of Orientalists, sitting at St. Petersburg in September last, I have the honour to make the following Report:—

In the domain of Geography, perhaps the most interesting feature of the meetings was the exhibition by Colonel Sossnofsky and Dr. Piacetsky of photographs, water-colour drawings, raw and manufactured products, &c., illustrative of the nature and resources of the countries travelled over during the expedition of those officers to China in 1874–75. The object of their expedition, semi-commercial and semi-political, is set forth in the Report made by the former officer to his Government. Through his courtesy in supplying me with a copy, I am enabled to submit the accompanying abstract,* embodying the gist of the geographical research, for the information of the Fellows of the Geographical Society. I believe the information to be very valuable, as it treats of a comparatively unknown part of the country.

Colonel Sossnofsky intimated his intention of presenting to the Royal Geographical Society an album of photographs illustrative of his expedition, which will no doubt prove as interesting as it is valuable.

Among other communications of interest made to the Congress, was a Paper by Dr. Neumann, a gentleman in the Russian service, and Vice-President of the Siberian Section of the Congress, on his expedition to the Tchoukchis. An abstract of the Paper communicated to the Siberian Section of the Russian Geographical Society, of which that read before the Congress of Orientalists was an abridgment, is herewith submitted.

Lastly, an interesting Paper was read in the Central Asian Section by Mr. Tcharikoff, Secretary in the Department of the Archives in the Ministry of Foreign Affairs at Moscow, relating to the mission sent in the year 1669 by the Tsar Alexis, father of Peter the Great, to the Khans of Bokhara, Khiva, and Balkh, and giving some information of the condition of those countries at that epoch. A translation of his communication is likewise submitted

In the domain of Cartography the list of maps and plans exhibited in the halls of the Congress is given in Appendix A. These maps are all of recent date. Besides these there was a very unique collection of less recent maps, charts, &c., of different parts of Asia, lent for the occasion by permission of the Minister of Foreign Affairs, and belonging to the Moscow Archives. A catalogue of these maps is given in Appendix B of this Report.

A list of the Presidents and Vice-Presidents of Sections is shown in Appendix C, from which it will be seen that four Fellows of the Geographical Society of

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* This abstract will be published in the 'Journal of the Royal Geographical Society.'

London, and three other Englishmen, of considerable repute in Oriental lore, were honoured by appointment as officers of the Congress.

In conclusion, it only remains for me to place on record the sense of gratitude of the English members, for the kindly manner in which they were welcomed, and for the hospitality and attention which they received at the hands of His Majesty the Emperor and of the community at large during their stay at St. Petersburg.

I have the honour to be, Sir,
Your most obedient servant,
F. C. H. CLARKE.

Sir RUTHERFORD ALCOCK, K.C.B., *President of the Royal Geographical Society.*

APPENDIX A.—*Maps exhibited at the Congress.*

1. Map of the Turkestan military district, Tashkent, 1872. In 4 sheets; 40 versts to the inch.
2. Map of the Territory of the Orenburg Cossack Contingent, showing the Kurgans. Original survey by M. Koroleff, 1876; 3 versts to the inch.
3. Map of Hissar and of the Bekate of Kuliab, compiled from Vishnevskin's Notes (astronomical points by Schwartz) made during the Expedition of 1875, under Major Maeff. Original survey; 10 versts to the inch.
4. Map of the Orenburg District (180 sheets); 10 versts to the inch. 1867.
5. Map of the Naryn District, by Major-General Kraefsky, 1868, embodying the Reconnaissances of Baron Kaulbars in 1869. Original survey; 5 versts to the inch.
6. Map of Kohistan, prepared during the Iskander Kul Expedition, by Startzeff and Klassen, under the direction of Baron Aminoff, 1870. Original survey; 5 versts to the inch.
7. Map of the Western District of the Chinese Empire, from Chinese maps and other sources, by Messrs. Zakharoff (Consul at Kuldja) and Niphantieff. Original survey, 1858; 50 versts to the inch.
8. Map of the Tian Shan Mountains, from Chinese maps, by Messrs. Zakharoff and Niphantieff, 1858. Original survey; 25 versts to the inch.
9. Map of Dau Kara (Khiva) and neighbourhood, 1873; 5 versts to the inch.
10. Map of the Khanate of Khiva and the lower course of the Amu Darya, 1873. $\frac{1}{550000}$.

APPENDIX B.—*Indicateur des Cartes Géographiques et des Plans de différentes parties de l'Asie, appartenant à la Collection Cartographique de la Bibliothèque des Archives Principales du Ministère des Affaires Etrangères à Moscou.* (Rédigé par A. RATCHINSKI, employé aux archives, délégué au 3^e Congrès des Orientalistes à St. Pétersbourg.)*

1. Geographiae Blavianae—volum. Decimum, ubi Asia describitur. Amstelodami 1662 (imprimé), f. 3.

2. L'Asie, divisée en tous ses Etats, dressée et gravée par Chambon. Paris 1754 (imprimé), f. 12.

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* The numbers of the folios given at the end of each article correspond with the folios of the Cartographical Catalogue in the Moscow Archives.

The numbers in black figures correspond with the ordinary numbers of the Catalogues.

3. Carte de la partie septentrionale et orientale de l'Asie, qui comprend la Grande Tartarie, le Kamtchatka et Yesso avec la mer Glaciale et ses côtes, dressée en 1764 par M*** (gravé), f. 13.

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18. Carte de la délimitation entre la Russie et la Chine d'après le traité de Golovine, dressée par les géomètres *Skobéltzine* et *Schatilow* (manuscrit), 1689, f. 37. No. **12.**

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52. Carte des côtes maritimes depuis l'embouchure du fl. Léna jusqu'au fl. Oud, dressée par l'aspirant de marine Philippe *Vertliougow*, en 1767 (manuscrit), f. 42. No. **56**.

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54. Carte des côtes maritimes, depuis le fl. Oulia jusqu'au point Tchoukote, dressée d'après les voyages entrepris dans les années 1764–1768 (manuscrit), f. 42. No. **52**.

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59. Le fort Oudinsk, de la même époque et origine (manuscrit), f. 44. No. **71**.

60. Plan d'une nouvelle station commerciale construite près du fleuve Argoune, dans le district de Nertchinsk; de la même époque et origine (manuscrit), f. 44. No. **72**.

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65. Plan d'un fort nouvellement construit en 1729, pour défendre les magasins de Tchakoï, dressé par *Kouschelew* (manuscrit), f. 45. No. **77**.

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67. Deux projets des forts de Nertchinsk et Ssélenguinsk, de la même époque et origine (manuscrit), f. 45. No. **79**.

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83. Carte du parcours du fl. Irtysch depuis le fort d'Omsk jusqu'à Tobolsk, dressée par *Isléniew* en 1780 (imprimé), f. 82. No. **8**.

84. Onze feuilles de la carte du parcours du fl. Irtysch depuis Tobolsk jusqu'au fort de Sémipalatinsk, dressée par *Muller* pendant l'expédition du Kamtchatka (manuscrit), f. 82. No. **9**.

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86. Carte des steppes et pays situés près des sources des fleuves Ob, Toma et Irtysch (manuscrit), f. 82. No. **11**.

87. Carte des pays situés entre les fleuves Tobol et Angara (manuscrit), f. 82. No. **13**.

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101. Plan des mines d'or et d'argent à Zinéyew (manuscrit), f. 85. N. **30.**

102. Plan de la distance entre Tobolsk et le fort d'Okhotsk, avec des notes sur les différentes déviations du compas, et une indication des lieux habités par les Ostiaks, Toungousses et autres peuplades. Dressé en 1725 et 1726, lors du voyage en Sibérie du capitaine *Behring* (manuscrit), f. 85. No. **32.**

103. Carte, communiquée en 1732 par le capitaine *Behring*, d'une description des côtes de la Sibérie et des lieux qu'il a parcourus de Tobolsk jusqu'au Kamtchatka (manuscrit), f. 85. No. **33.**

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105. Trois exemplaires d'une carte des lieux de campement des Kalmouks dans les possessions du Kontaïcha, avec une partie de l'empire de Chine et de la horde des Kasaks, dressée en 1722 et 1723 par le capitaine d'artillerie *Ounkowskoi*, lors de son séjour chez le Kontaïcha, f. 85.

106. Plan des pays situés sur les confins des possessions des Chinois et du Kontaïcha, dressé par le voyévode de Yakoutsk *Poloujektow*, et communiqué par le vice-gouverneur de Tobolsk *Boltine* en 1730 (manuscrit), f. 85. No. **37.**

107. Trois feuilles d'une carte du cours du fleuve Irtysch près de Tobolsk et à travers le lac Norsaïssan, avec l'indication des affluents de ce fleuve, dressée par le géomètre *Tchitchagow* sous la direction du major *Likharew* (manuscrit), f. 86. No. **37.**

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110. Carte de différentes mines et usines, situées entre les fleuves Ob et Irtysch et au-delà d'Ob (manuscrit), f. 86. No. **41.**

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112. Carte complète des districts de Tomsk et de Kouznetzk, et particulièrement des usines de Kolyvano-Voskressensk (manuscrit), f. 87. No. **2.**

113. Plan d'un volcan près la ville de Kousnetzk, f. 81. No. **5.**

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1°. Tableau de la sphère céleste en chinois sur 3 feuilles, f. 11. No. **2.**

2°. Cinq tableaux du globe terrestre en arabe, f. 11. No. **5.**

CARTES FRONTIÈRES,

Ou des Pays Limitrophes a l'Empire de Russie.

1. *Chine.*

Trois cartes frontières des Empires de la Russie et de celui de la Chine, **transmises au collége** des affaires étrangères par le gouverneur de la Sibérie *Soymonow* en 1758 et en 1762 (manuscrit), f. 95. No. **1.**

2. *Perse.*

1°. Deux cartes indiquant comment doivent être les frontières de la Perse. Dessin transmis au C. D. A. E. en 1726 (manuscrit), f. 96. No. **1.**

2°. Frontières des Empires de Russie, Perse et Turquie. Dessin envoyé en 1725 par le prince de Géorgie *Vakhtangue* (manuscrit), f. 96. No. **2.**

3°. Copie d'une carte de la frontière de Perse, dressée de mémoire, sur deux feuilles (manuscrit), f. 96. No. **3.**

CARTES DES PAYS ÉTRANGERS.

1. *Inde Orientale.*

Hindostan, de *F. Kennell* F. R. I. 1782 (imprimé) sur deux feuilles, f. 105.

2. *Chine.*

1. Carte des îles du Japon dressée par *Bellin* en 1735, f. 106.

2. Carte donnant les contours du Japon, de la Corée, de l'île d'Esso et du Kamtchatka (manuscrit), f. 106.

3. Trente cartes de la Chine, de différentes dimensions; légendes chinoises; quelques-unes d'entre elles portent des notes faites en russe (manuscrit), f. 106.

4. Dessin d'une église nouvellement construite à Pékin. Les dimensions sont rendues par un cordon, qui porte des marques en papier avec inscriptions des longueurs et largeurs, etc., etc. Ce dessin a été envoyé de Chine en 1732. f. 106. No. **4.**

3. *Perse.*

1. Provinciarum Persicarum Kilaniae, nempe Chirvaniae, Dagestaniae Geographica tabula. Auct. Homanno. Norimbergae, f. 109.

2. Plan de Kandahar, transmis par le président *Jean Kalouschkine* en date d'Ispahan, du 17 mai 1783 (manuscrit), f. 109. No. **2.**

3. Carte du Hilan et des autres provinces situées sur les côtes de la Caspienne. Transmis par le lieutenant-général *Lévaschow* en 1729 (manuscrit), f. 109. No. **3.**

4. *Tartarie.*

1. Carta partis Asiae, quam ob varia viarum pericula et immensos itineris labores nemini peregrinatorum numsque contigit oculis videre. Auct. Basilis Batatzi., Londini 1732 cum explicatione (en latin et grec). Elle représente les peuples habitant aux environs des mers Caspienne et Aral, etc., les Kalmouks, Karakalpaks, Tourkestans, Ousbeks, Kirghizes, etc., etc. (imprimé), f. 110 additionnelle.

2. Carte nouvelle de la Grande-Tartarie par M. Witz. Amsterdam, sans date, f. 110.

3 Carte de la horde Kirghize-Kaïssaque centrale, en tataro (manuscrit), f. 110. No. **3.**

4. Dessin exécuté d'après les témoignages oculaires sur Khiva par le directeur de la douane d'Orenbourg, M. *Velitchko* (manuscrit), f. 110. No. **4.**

5. Plan de la cité de Khiva (manuscrit), f. 110.

6. Carte des pays des Karakalpaks et Ousbeks, situés sur les côtes orientales de la mer Caspienne, autour de la mer d'Aral, avec des indications des lieux très détaillées (manuscrit), f. 110. Voyez le titre détaillé à la page 1re (4 et 5).

5. *Zungarie.*

Carte de la Zungarie, dressée en 1724 par le capitaine Ounkovskoï, ambassadeur de Russie auprès du Khan Zungar. (Extraite du dossier de l'an 1724. Zungarie, No. 1). Voyez p. 8, 106.

CARTES MARITIMES.

Carte Mercator, dressée par le négociant d'Oustiougue *Nikita Schalaoukhow*, de son voyage entrepris en 1762 dans le but de découvrir une nouvelle voie à travers l'océan Arctique. No. 7.

APPENDIX C.—*List of Officers of the International Congress at St. Petersburg*, 1876.

President of the Congress	M. Grigorieff (R.) *
Presidents of Sections :—	
1. Siberia	M. Vassilieff (R.).
2. Central Asia	M. Ch. Schéfer (F.).
3. Caucasus	M. Gamazoff (R.).
4. Trans-Caucasia	M. Patkanoff (R.).
5. Extreme East	M. de Rosny (F.).
6. India, &c.	M. Kern (H.).
7. Turkey	His Excellency Ahmed Véfyk (T.).
8. Archæology	M. Oppert (F.).
9. Religious Systems	Mr. Douglas (E.), British Museum.
Vice-Presidents of Sections :—	
1. Siberia	M. Slovtsoff (R.). M. Neumann (R.).
2. Central Asia	M. de Goeje (H.). M. Veliaminoff-Zernoff (R.).
3. Caucasus	Mr. R. Cust, F.R.G.S. (E.). M. Berger (R.).
4. Trans-Caucasia	Mr. F. Clarke, F.R.G.S. (E.). Mr. E. Eastwick, C.B., F.R.G.S. (E.).
5. Extreme East	M. Zakharoff (R.). M. Lagus (R.).
6. India	M. Sachau (G.). M. Kossowicz (R.).
7. Turkey	Mr. Wright (E.), Cambridge. M. Mehren (D.).
8. Archæology	M. Tiesenhausen (G.) M. Stickel (G.).
9. Religious Systems	M. de Gubernatis (I.). Mr. Chenery (E.), Oxford.
General Secretary	Baron Osten-Sacken (R.).
Assistant Secretary	Baron Rosen (R.).
Secretaries of Congress	M. Derenbourg (F.). Mr. D. Morgan, F.R.G.S. (E.). M. Joannidi (Gr.). M. Smirnoff (R.). M. Tcharikoff (R.). M. Terentieff (R.).
Treasurer	M. Giurgass (R.).

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* The letters (R.), (G.), &c., after the name denote the country of which the individual is the representative. (R.) Russia, (F.) France, (G.) Germany, (Gr.) Greece, (I.) Italy, (H.) Holland, (D.) Denmark, (T.) Turkey.

2. *The Tchoukot Expedition in* 1868. By Dr. Carl Neumann.

[Translated and communicated by Capt. Clarke.]

THE whole of the north-east of Siberia is peopled by three different tribes, called by the common name of the Tchoukchis. These three tribes are: (1) The Reindeer Tchoukchis; (2) The Aigwanis, who live along the Tchoukchi promontory; and (3) The Nammols, to the east of Cape Cook. It was to the first-mentioned tribe that the expedition, of which Dr. Neumann was a member, was undertaken in 1868. This tribe occupies the territory between Behring Strait and the Kolym on one side, and between the Glacial Sea and the River Anadyr on the other. The climate of this region is so severe, that there are few nights in the year in which it does not freeze. Under such unfavourable conditions, vegetation is very scanty; it consists mostly of lichens.

The animals met with are the reindeer, the black bear, and certain birds, which migrate here for a short time in spring, and enliven with their song the mournful solitude of these vast wastes. There are no precious metals, nothing to attract man. The Tchoukchis, however, are not the first inhabitants. The Yakuts emigrated from the Baikal to this country, probably in the time of Chengiz Khan.

The author believes with Miller that the Tchoukchis came from the other side of Behring Strait. In the country, new to them, they found settlements of Koriaks, with whom they waged sanguinary conflicts until the year 1740.

At the present time the Tchoukchis number about 3000 souls.

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On the 15th of August, 1868, says Dr. Neumann, we left Irkutsk, and arrived at Yakutsk on the 22nd of September. We passed five weeks at Yakutsk in order to complete the equipment of our expedition, which started on the 30th of October, and on the 1st of November reached Aldan (in Djeli). Djeli is about 140 miles from Yakutsk. On the 7th of November we left Aldan, with an escort of two Cossacks of the Yakutsk Regiment, and five Yakuts as guides.

From Aldan to the Verkhoi Range is reckoned 145 miles, the way lying through a district entirely uninhabited. For more than half the distance the road trends along the Valley of the Tukulan, which river, taking its rise in a small lake in the mountains some miles from the place where the road intersects the range, falls into the Aldan from the right bank. The Tukulan has the characteristics of a mountain-stream; it forces its way through narrow defiles, overflows its banks in the spring and in rainy weather, uprooting in its impetuous course the poplars and larches which have stood for centuries. The fallen trees make travelling difficult, and greatly fatigue the already exhausted horses, whose only food consists of the leaves of trees, and some occasional blades of wretched grass, from the surface of which the snow has been previously scraped away with their hoofs. On this road it was that we made our first acquaintance with the so-called "kitchens," small cabins or huts, generally of an hexagonal form, with a slightly convex roof. Each side of the hexagon is some 7 feet in length, and the roof is covered with a layer of a few inches of earth, space being left for the exit of the smoke from the fireplace. These cabins are constructed along the road at intervals of 25 to 35 miles, at those points where there happens to be fuel and grass.

Wretched as they are, the half-frozen traveller in this dreary waste hails with delight the appearance in the distance of the smoke and sparks issuing from the roof, and with a feeling of special satisfaction finds on arrival the small fire kindled by the Yakut guide sent on in advance. It is impossible to understand why the Yakut traders who traverse this district every year do not erect something better—for instance, *yurtas*,* which are in every way superior to these wretched hovels, where the smoke hangs in a thick cloud, causing the eyes to smart, and into which the wind finds its way at pleasure, and threatens each minute to chill one to the bone—to say nothing of having to throw out the snow which falls through the smoke aperture. Is it that use is second nature?

On the 11th of November we reached the kitchen at Kurum-Hopchagai, about 45 miles from the pass over the range, and there had to wait for twenty-four hours, as we received information from some roving Tunguzes that there was no chance of our being able to cross the range, owing to the strong wind, but that in two or three days there was every probability that the wind would subside. The weather at Kurum-Hopchagai was so bad, that it was impossible to make observations for determining the latitude.

On the 14th of November we reached the last kitchen on this side of the Cis-Anna Range. The forecast of the Tunguzes proved correct; the wind subsided, and we crossed the mountains. The whole of the little district of Teriah-Yurea is treeless. I determined the position of this place in spite of the thermometer registering 26° R. below zero. The pass over the Verkhoi Range is very difficult, and occupies about seven hours, the southern slopes presenting greater difficulties than the northern. The highest point of the ascent was, according to the registration of the barometer, 4700 feet above the level of the sea. On the summit stands a cross, upon which the passing Yakut hangs a lock of his horse's mane, or a rag, as a thank-offering for his safe passage of the mountains. On either side of the highest point of the road the mountains rise to a further height of 700 feet, so that the range attains an elevation of 5400 feet. Here is also the lake from which the River Keh-Yuriah takes its rise. This river, at a distance of 12 miles from its source, unites with another mountain-stream, the Teriah-Yuriah. The two streams form the Sartan, which, on being joined 6 miles above the town of Verkhoiyansk by the Dulahaloh, changes its name to the Yana.

On the 24th of November we reached Verkhoiyansk by the post-road. On the way thither I took some observations, but, with the thermometer at 41° R. below zero, it was a matter of great difficulty, and it is impossible to ascribe great accuracy to them under the circumstances. It will be quite sufficient to mention that, after previously warming the instrument at the fire, less than five minutes in the open air suffices to congeal the lubricant, and prevent the axis and screws of the instrument from working; to say nothing of the risk run of having the fingers frozen by contact with the instrument, as the thickest gloves afford no protection.

The climate had changed ever since we had passed the mountains. For three weeks the thermometer fell below 40° R., and was even as low as 48° R. below zero. The lowest observed temperature during the year 1869 at Verkhoiyansk was 52°·2 R. below zero.

At Verkhoiyansk we heard of the mammoth found by a Tunguz in the River Homos-Yurea, which falls into the sea between the Indigirka and the Alazeya.

On the 5th of December we left Verkhoiyansk, and reached Tabalah on the 10th, where we remained four days. Here we changed our mode of conveyance from horses to reindeer-sledges.

Leaving Tabalah on the 14th, we passed through the districts of Tostah (26 miles), and Tiugun-Erestiah (50 miles), and thence through the defile of the River Habarofka, which falls into the Dogdo.. The Dogdo in its turn falls into the Adicha, which also receives the waters of the Tostah. The Adicha flows into the Yana, not far from Tabalah. Along all these rivers there are roads. The River Habarofka at this point flows between high mountains of black and yellow schist.

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* Tents of felt.—TRANSLATOR.

The water-parting between the Yana and the Indigirka consists of a spur from the Verkhoiyansk Range, the Tass-Hayatah, which stretches nearly due north and south between those rivers. (Here rise the Dogdo and Seleniah.) There is another similar spur from the same range which forms the parting between the Indigirka and the Alazeya. The so-called Alazeya Range is also parallel to the other two, and separates the waters of the Alazeya from the western affluents of the Kolym. All these chains are much lower and less abrupt than the Verkhoiyansk Range, and near the Ledovit Sea take the form of low hills. The Alazeya Range forms the boundary between the districts of Verkhoiyansk and Kolym.

On the 16th of January we arrived at Srednie-Kolymsk, a town of fifty houses, lying on both banks of the River Ankudin, which enters the River Kolym close to the town from the left side. A detachment of forty Cossacks is stationed in the town.

Here we met the Tchoukchis for the first time. In 1866, owing to their pasturage failing, they had petitioned the Russians to be allowed to transfer their habitations from the right to the left bank of the Kolym: to the so-called Great Tundra, a district bordered on the north by the Ledovit Sea, on the east by the Kolym, on the west by the Indigirka. On the south its frontier may be approximately stated as the River Fedotika, which flows into the Kolym from its left side in about 67° N. lat.

The Tchoukchis now once more renewed their request, which was granted, and some fifty migrated at once. The impression produced by these people was exceedingly agreeable. They are of high stature, well proportioned, and with a type of face neither Mongol nor Tartar. In answer to our inquiries as to the present place of abode of their chief, Amraoorgin, they replied that he was probably at the sources of the Great Anyui and Chaun rivers.

On the 12th of March we left Srednie-Kolymsk in our reindeer-sledges, and passing through Butalah, Sigdy-Itar, Olbut, and Pomaskino, reached Kresta, a distance of 185 miles. From Kresta we proceeded with dogs to Nijne-Kolymsk, about 130 miles. The road runs along a river, through the villages of Omolonska and Timkino. This distance of 130 miles is usually traversed in two days.

We arrived at Nijne-Kolymsk on the 17th of March, when the fair was at its height. We remained here five days. The barter consists of skins for tobacco. The town is nothing more than a few huts; the old fort is in ruins.

On the 23rd of March we left for the Anyui Fort, a distance of 170 miles. The road at first follows the Kolym, and afterwards the River Little, or Dry, Anyui; its banks, once inhabited by the Yukagirs, are now depopulated, as the wild reindeer, man's only means of existence in these parts, no longer come down to it.

On the 25th of March we reached the Anyui Fort. After we had been there a few days, we were visited by Amraoorgin, chief of the Tchoukchis, or, as he is sometimes called, Taen (in the Takut language this is equivalent to lord or master), a man about 56 years of age.

Here we were introduced for the first time to a Tchoukchi *cuisine*. The repast consisted of frozen fish, frozen reindeer-marrow, smoked reindeer-tongues, and boiled reindeer-flesh, winding up with frozen pigeon, a favourite dish of the Tchoukchis.

When dinner was over, we proceeded to witness the games of the women. They sang songs, if you can call by such name the discordant noises we heard. Their dances, in which only the women take part, are very original; they gesticulate with their arms alone, keep the feet almost still, mimicking and making grimaces the while.

On the 4th of April we made a start. This day may be considered the commencement of the Tchoukot Expedition, as it was then that we began to wander amid the Tchoukchis. Our party consisted of four Russians, three Cossacks, and Amraoorgin and his suite. We proceeded in reindeer-sledges about 8 miles up the Anyui to the mouth of the River Kobeleff Liarhan, which flows into the Anyui from the left side, and then up that river for 2 miles. On the 5th we proceeded about 20 miles up the Liarhan, and passed the night at the foot of a small mountain-chain. Next day we crossed this range, and descended to the Kamenni River (an affluent of the Orlofka), which falls into the Great Anyui. These mountains consist of red porphyry and black slate. Their height is about 2000 feet, and in them are found quantities of wild sheep (*Ovis nivicola*), an animal met with throughout the Tchoukot country as far as the Ledovit Sea. Hunting them is rather dangerous, as they are very savage when wounded. Their flesh is sweet, fat, and not unlike venison.

On the 7th we debouched on the Orlofka, and proceeding along it for 13 miles, came to the River Berezofka, which falls into the Great Anyui. We followed its course as far as its mouth (12 miles).

On the 8th we marched 25 miles up the River Anyui. On the 9th we parted from this river, and commenced the ascent of the mountains. It was not steep, but rather long. We completed about 28 miles this day, and 33 miles on the next, when we halted on the upper course of the river.

On the 11th we only marched 10 miles, as the quantities of large stones encumbering the river made our progress difficult.

On the 12th and 13th, after a journey of 40 miles, we reached Amraoorgin's residence, making a total distance of 200 miles completed in ten days. On this day we shot some partridge of a remarkable kind (*Lagopus alpinus*), which we had only seen once before at Tabalakh, and the existence of which is disputed by Pallas.

The place where Amraoorgin has wintered for several years in succession is in 66° 35·2′ N. lat., and 166° 22′ E. of Greenwich, and about 2000 feet above the level of the sea. It consists of a rather broad plateau, about 10 miles across, surrounded on all sides with high mountains. Vegetation is sparse, but, what there is, is well-leafed. Here we became acquainted with the home-life of the Tchoukchis. Amraoorgin has three wives. By his eldest wife, Anna, a poor girl of the Chuvan tribe, who saved his life from a black bear, he has had one son and three daughters. His second wife is Maria, by whom he has one daughter. These ladies are no longer young. His third wife is a young and pretty woman, to whose parents he paid a whole herd of reindeer, in order to obtain her.

The Tchoukchis are very proud of their children, and spoil them.

On the 23rd of April we were again *en route*. Ascending a small stream, we reached on the 26th the source of the River Tenneke, which falls into the En-moa,* one of the tributaries of the Anadyr. The other sources of the Anadyr are the Kim-gim (Red or Great Peledon) and the Anetva (Little Peledon).

The geological formation of the low range of mountains separating the waters of the Great Anyui from the affluents of the Anadyr is porphyry, diorite, yellow and black slate, and occasionally granite. Trees are scarce, and are only found on the south side—larches, poplars, and low willows. From this point we intended to reach Kolinchen Bay, and thence East Cape; but were dissuaded from doing so by the Tchoukchis, on the grounds that there was no grass for the reindeer. We therefore determined to move southward.

About the 20th of June we were much plagued with gnats, which literally darkened the air, so that the sun could not be seen. With them appeared spiders, the *bête-noir* of the reindeer. They lay their eggs under the skin of the animal, and the larvæ, when hatched, torment them severely. In July, the summer season, the thermometer seldom rose above 13° R., and seldom fell below 0°.

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* Called Mechkeroba by the inhabitants of the villages of the Anadyr.

We also met with another tribe of sedentary Tchoukchis. In appearance they are very like the Reindeer-Tchoukchis; but their language is entirely different. The Reindeer-Tchoukchis call them Ang-kali, which means "near the sea." They do not breed the reindeer, but live on fish, walruses, and seals. But as their clothing consists of reindeer-skins, they are more or less dependent on the Reindeer-Tchoukchis, by whom they are regarded as inferior.

I will here remark, *à propos*, that Rink, the Danish savant, formerly the Director of the Danish Colonies in Greenland, and a gentleman thoroughly acquainted with the life and language of the Esquimaux, sent us a book of tales and traditions of that people, and, supposing them to be of the same descent, asked us to find out and communicate to him whether the same tales exist among the sedentary Tchoukchis. But I can confidently assert that with neither the one nor the other tribe of Tchoukchis does anything of the sort exist. One of their few traditions is that their forefathers came at one time from the other side of Behring Strait. Another is one of the creation of the world. It was narrated by the sedentary Tchoukchis as follows:—In the beginning one pair of human beings was created, from whom sprung all nations. Each of these occupied himself with his handicraft according to his mission and peculiarities.

On the 1st of August we at length saw the sea. This was Kanchelon Bay. The small and rocky islet in it is called Pericheff. The sea was only 20 miles distant, but it took us eighteen days to reach it, owing to the heavy rain and the impediments of small rivers, which we were unable to cross, there being no wood to make boats.

On the 19th of August we reached the high steep bank (about 280') at the mouth of a small river, where we pitched our camp in lat. 64° 48′ 23″ N. and 11h 55′ 55″ E. of Greenwich. We remained until the 3rd of September, by which date the last of the birds of passage had taken his departure—the grebe (*Cepphus arcticus* of Pallas).

On our return journey we did not take the route along the bank of the Anadyr, but one about 65 miles to the north of it. On the 16th of September, snow beginning to fall, we once more took to our sledges; and on the 19th of October reached the Anadyr, and the first Russian houses. In these houses, however, there were no inhabitants; they serve only as summer residences for the inhabitants of the villages of the Anadyr at the time when the fish ascend the river, and when the wild reindeer cross it. Reindeer proceed in the summer in vast herds to the Ledovit Sea, to escape their tormentors, the gnat and the spider, and in the autumn, towards the end of August, return to their pastures. During their autumn wanderings no obstacles stop them, no rivers detain them. In thousands and tens of thousands they swim across even such rivers as the Anadyr, 2000 yards in breadth. Then commences the hunting season.

On the 8th of November I left for Nijne-Kolymsk. The road lay across the Anadyr for 10 miles, and then for seven days up the River Podyemnoi to its source. Then across the mountains, the ascent of which was so steep that we only accomplished 9 miles in two days.

The Anadyr Range is a continuation of the Verkhoiyansk, but much lower. It does not exceed 5000 feet in height. In nearly all the maps it is wrongly placed. It is there shown as an off-shoot of the Stanovy Range, with which it has nothing in common. The Anadyr Range forms the water-parting between the northern affluents of the Anadyr and the rivers flowing into the Ledovit

Sea. In the place where I crossed it in the winter of 1869, one of its spurs separates the waters of its eastern affluents, *e.g.* Sabachia, Spuskovaya, and Dressvianaya, from its northern affluents, *e.g.* the Podyemnoi. If we take a look at the course of the Anadyr on the map, and find the place where this river bends abruptly from north to east, my words will be perfectly plain. I arrived at Nijne-Kolymsk on the 2nd of December, having accomplished 800 miles in twenty-four days.

During my stay at Nijne-Kolymsk, I determined the longitude of the place by a series of lunar distances to be 160° 56′ 3″, and its latitude 68° 31′ 56″, which agrees very closely with Wrangel's observations, viz. 160° 56′ 34″ and 68° 31′ 53″ respectively.

3. *A Voyage to Uzbegistan in* 1671–72.* (From documents preserved in the Archives of the Ministry of Foreign Affairs at Moscow.)

[ABSTRACT by Capt. CLARKE, R.A.]

IN the year 1669 Boris Andréyéwitch Pazukhin was sent by the Tsar Alexis Mikhailowitch (father of Peter the Great) to the khans of Khiva, Bokhara, and Balkh. He left Moscow on the 30th of June, 1669, provided with letters from the Tsar, and presents for the different khans. Descending the Rivers Moskwa and Oka, he arrived on the 20th of July at Kazan, from which place he passed down the Volga to Astrakhan, after being joined by an escort of *Streltsi* (the soldiers of that epoch). In consequence of the delay of the escort, however, it was not until August of the following year that Astrakhan was reached.

In the seventeenth century, according to Pazukhin, there were three routes into Uzbegistan: (1) Across the Caspian to Astrabad, and thence by Meshhed and Merv to Bokhara—a journey of fourteen weeks;† (2) From the Port of Karagan on the Mangyshlak Peninsula to Khiva. From Karagan to Khiva was only four weeks' journey, but the duration of the passage from Astrakhan to Karagan depended on the force and direction of the wind. This was the shortest route, but the most dangerous, both on account of the storms, which were of constant occurrence, particularly in autumn, and also owing to the aggressive character of the nomad Turkoman tribes inhabiting Mangyshlak. (3) Lastly, Khiva could be reached by passing along the northern side of the Caspian. This was the route selected at the recommendation of the Voyvod of Astrakhan, Prince Prosorovsky, as being the least dangerous. But it was impossible to proceed without guides and an escort, and at the order of the Tsar, transmitted by the Voyvod, the Calmuck Khan, Daitchine Taïsha, encamped on the banks of the Ural, placed six of his subjects at the disposition of the envoy.

Pazukhin purchased at Astrakhan nineteen camels, and left on the 10th of March, 1671, for Khiva.

After fourteen days' march he arrived on the River Ural, at the camp of the Calmucks, who, like other nomads, were preparing at this season to move to more northerly regions, from which they return in the autumn.

On the 1st of April, Pazukhin quitted the Calmuck camp, and, after halting for a day on the 31st of the same month on the banks of the River Saniz, at the encampment of the tribe (*uluss*) of Nazar Mahmoud, grandson of Daïtchine

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* Communicated and read by Mons. Nicholas Tcharikoff, at the Congress of Orientalists at St. Petersburg in 1876.

† A day's journey (duishtché)=20 miles.

Taïsha, the Russian envoy arrived on the 14th of May before Kata, the first town in Khivan territory,* two days' journey from the capital.

The Khan of Khiva, Navsha Mambet Khan, had already sent to this town to meet Pazukhin *Khoudaberdei*, who acted as commissary to all foreign missions coming to Khiva.

On the 16th of May, Khoudaberdei, accompanied by some soldiers, Uzbegs, and others, met Pazukhin and his suite a few miles from the town. Khoudaberdei greeted the envoy in the name of the Khan, and presented on behalf of his master a richly-caparisoned horse. He conducted him to the village of Djanarobei, where tents were prepared for the travellers, and afterwards proceeded to announce the arrival of the mission to the Khan.

Two days later, Pazukhin and his suite made their entry into Khiva mounted on magnificent horses provided by the Khan, and accompanied by two *Yassauls* (persons of rank), a hundred Uzbegs, and large numbers of citizens. The envoy and his suite were lodged in the old palace of the Khan.

The audience took place on the 21st of May. The Khan received Pazukhin seated on carpets spread over the floor of the "golden room," which was situated in the middle of his garden. Near the Khan were seated twenty-four *Atalyki*, and other personages of the Court; in front of the door were *Yassauls* with long sticks, and upwards of a hundred Uzbegs. The Khan took from Pazukhin's hand the letter of which he was the bearer, inquired after the health of the Tsar, and listened to the envoy's address.

Afterwards various eatables were handed round on silver plates, with water and milk (probably *Kumis*) in golden goblets. When the repast was over, Pazukhin returned to his domicile.

The presents which Pazukhin had brought for the Khan, as well as those which he distributed to the persons of the Court, were received with evident feelings of satisfaction.

On the 24th of the same month Pazukhin was again invited to the Khan's palace, and, after a similar repast, the Khan, at Pazukhin's solicitation, gave him permission to proceed to Bokhara. At this audience the question of liberating the captive Russians in Khiva and the surrounding countries was discussed at length between the Khan and the envoy. The former ultimately promised that the traffic in Russian prisoners should cease, that they should no longer be sold in distant countries, and, while awaiting the Tsar's answer relative to the purchase of the prisoners, agreed that a certain number of Russians should be sent gratuitously to Moscow with Pazukhin when the latter again passed through Khiva on his return to Russia.

Leaving Khiva on the 3rd of June, Pazukhin arrived on the same day at the town of Khanki—all the towns mentioned by Pazukhin still exist—and the next day at Azarist (Khazar-asp), and after crossing the Amu, reached the frontier of Bokhara. After a march of eight days across the desert, the Russian caravan halted not far from the first town in Bokhara—Kara-Kol.

The Dar-aga of the place, a functionary charged with the administration of justice in commercial matters, and with receiving custom and other dues, received Pazukhin in the same manner as the Khivan commissary had done. The Dar-aga informed Pazukhin that the Khan of Bokhara, Abdul Aziz (or Abda Aziz) had left for the frontier with his troops, in order to give battle to the Khan of Balkh; that he was at the time in the town of Karshakh, and would be apprised of the arrival of the Russian mission.

On the 23rd of June the Russian envoy entered Bokhara, where he was received by Tash-Boulat Bii, to whom the Khan had entrusted the care of the capital during his absence.

It was not until December that Adbul-Aziz returned to Bokhara. Pazukhin had meanwhile studied the political and economical condition of the Khanates of Uzbegistan, and gives the following particulars with regard to their army and finances. The army of Bokhara, including the auxiliary troops furnished by the Karakalpaks, comprised upwards of 150,000 men. The army of the Khan of Balkh was less than half the size; while the army of the Khan of Khiva barely numbered 30,000 horsemen. In the event of war, not only the troops, but all the Khivan people—agriculturists, merchants, &c., took part, in the hope of obtaining booty. The mode of warfare which obtained with the Khivans was the same as with the Calmucks, and neither at Balkh nor Bokhara was there at that time any infantry or artillery. The Khans were not rich, as they had distributed nearly all their territory among their dependents instead of pay. The revenue was derived from a house-tax and custom-dues.

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* The precise halting-place was Koulabia, not far from Kata.

Throughout Uzbegistan cereals were sown and irrigation was indispensable. With regard to silk, Bokhara did not produce sufficient for its requirements, and in consequence exported nothing. Khiva produced annually about 16 tons of raw silk, which sold at about a rouble a pound.

The merchandise in greatest demand for the Khivan market included cloth, furs, skins, vessels of various kinds, pins and needles.

Soon after the return of the Khan to Bokhara, Pazukhin was received at the palace. The court of Abdul Aziz appeared much more extensive and brilliant than that of Navsha-Mambet. The Khan was surrounded by the Khosi—his relatives, and by more than 100 other personages of the court. On entering the reception-hall, Pazukhin was supported on the right by the *Divan-Begi* Mahmet-Mazir-Bei, and on the left by the chief magistrate, Datakhabek.

After Pazukhin had delivered the Tsar's letter to the Khan and read his address, the Khan invited him to be seated, and inquired about his journey, and about the court of the Tsar; and when Pazukhin complained of the molestation to which travellers to Bokhara were subjected, Abdul Aziz promised to write to the Khan of Khiva, with a view to his taking measures for protecting travellers from the nomads.

According to Oriental custom, Pazukhin had to make numerous presents, particularly to the Khosi, who told him, amongst other matters, that it was they who had protected the Russians at Bokhara during the civil wars; and they begged him, in the event of any disturbance in the capital, to come to them for shelter, as they would not plunder or give up those under their protection. Pazukhin had, however, no cause for seeking this protection, as Bokhara was tranquil during the whole period of his stay.

The subject which detained Pazukhin at Bokhara was the freedom of the Russian prisoners. At this epoch the traffic in Russian captives was systematically organised in Uzbegistan. The Calmucks and the Bashkirs made incursions into Russian territory, and carried off the inhabitants of the villages, the streltsi, and the merchants who came in their way. Khivan traders came to the Calmuck and Bashkir camps and purchased the captives. They were afterwards again sold in Bokhara, Persia, and elsewhere. The price of a slave at Khiva was at that time about 40 to 50 roubles. Pazukhin purchased the release of several Russian captives.

After a final audience with the Khan, Pazukhin quitted Bokhara.

Pazukhin had received instructions to visit the Khan of Balkh; but the war then raging between that country and Bokhara, rendered the project impracticable. Pazukhin, however, decided to send his interpreter, who reached the town safely, presented his letter, and on the 23rd of May, 1671, returned with one addressed to the Envoy by the Khan *Souphhane-Kouli-Khan*.

Pazukhin did not return to Russia by way of Khiva and the Calmuck territory, but took the road to the south of the Caspian, through Persia, having been informed that the Khan of Khiva contemplated preventing his return. Leaving Bokhara towards the end of October, Pazukhin arrived, after three days' march, at the frontier town of Tchardjui; and on the 5th of December, the weather being intensely cold, at Merv, the first Persian town. The commandant of the latter place having received authority from the Shah of Persia, then at Ispahan, to allow Pazukhin to pass, gave him guides to conduct him to the town of Meshhed.

From Meshhed Pazukhin proceeded to the south coast of the Caspian, and arrived, without mishap, at the port of Liagrane (Lenkoran), from whence he embarked for Baku.

Not finding at this latter place any vessel to take him to Astrakhan, and it being already October, Pazukhin decided to winter on the coast.

From Baku Pazukhin proceeded to Shemakha. During this winter he and his companions suffered very much from want of provisions; they were obliged to borrow food, amongst others, from the Ambassador of Poland, who was then at Shemakha. They were also constantly subject to the attack of Lesghians and Persians, who fired upon them and carried off one of the liberated Russian captives. The envoy had not been authorised by the Tsar to make reprisals, so he refrained from punishing these people, in order to avoid giving cause for differences between the Tsar and the Shah of Persia.

Pazukhin finally embarked on the 11th of June, 1673, for Astrakhan with his suite and several merchants; and on the 29th of the same month reached that place.

On the 9th of October Pazukhin returned to Moscow, after an absence of four years and three months.

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Sir RUTHERFORD ALCOCK, K.C.B., President, in the Chair.

Presentations.—*Commander Alfred A. Chase Parr*, R.N.; *Sir Henry Thring*, K.C.B.

Elections.—*William Andrews, Esq.*, C.E.; *Rev. Walter E. Browne; Samuel Davenport, Esq.; George Dobson, Esq.; John Emery, Esq.; Charles Henry Haines, Esq.*, M.D.; *Frank Oscar Karuth, Esq.; Robert A. Laing, Esq.; John Lobb, Esq.; Major Gerard Noel Money* (Bengal Staff Corps); *Commander Alfred A. Chase Parr*, R.N.; *Sir Henry Thring*, K.C.B.

Donations to the Library, 12th to 26th February, 1877.—Aus dem Natur- und Volkerleben im tropischen Amerika, Skizzenbuch, von Karl von Scherzer; Leipzig, 1864 (*Author*). The Balearic Isles, 1876, and The Cost of living abroad, 1876, by C. T. Bidwell (*Author*). Catalogue of the Library of the University of London, 1876 (*The Senate of the University*). The Coasts of Chile, Bolivia, and Perú; Washington, 1876 (*The U.S. Hydrographic Office, per Commander R. H. Wyman*). Haandbog i Geographien, af E. Løffler; Kjøbenhavn, 1876 (*Author*). Results of Observations at the Radcliffe Observatory, 1874, vol. xxxiv.; Oxford, 1876 (*The Radcliffe Trustees*). Polar Colonization and Exploration, by H. W. Howgate (*Author*). The Royal School of Mines Magazine, vol. i., Nos. 1 and 2 (*The Editor*). Les Voyages des Naturalistes Belges, par F. Plateau; Bruxelles, 1876 (*The Librarian R. G. S.*). Letter to the Shareholders of the Australian Agricultural Company, by R. H. Prance, 1877 (*Author*). L'Afrique et la Conférence Géographique de Bruxelles, par E. Banning, 1877 (*Author*). La Végétation du Globe, par A. Griesbach, traduit par P. de Tchihatchef, vol. ii., fasc. 1; Paris, 1877 (*M. de Tchihatchef*). The Grotto of Neptune, Sardinia, a poem illustrative of 3 views taken by the late Commander Alfred Miles, R.N., F.R.G.S., by Sibella E. Miles, 1864, with MS. poem on the late Arctic Expedition (*Mrs. S. E. Miles*). Statistical Register of Victoria, 1875, parts viii. and ix.; Reports of Mining Surveyors, &c., 30th Sept., 1876; and Victorian Year Book for 1875 (*The Victorian Government*). Early maritime intercourse of ancient Western nations, Japanese wrecks, and Origin of the Chinese race, by C. W. Brooks; San Francisco, 1876 (*Author*); and the current issue of publications of corresponding Societies, periodicals, &c.

DONATIONS TO MAP-ROOM FROM FEBRUARY 12TH TO 26TH, 1877.—MS. sketch-map of the Quilimane River, made by H. B. Cotterill, August, 1876 (*Bishop of Edinburgh*). Route-map of Rev. R. Price from Sadani to Mpwapwa (*Dr. J. Mullens*). The "Unrivalled" Classical Atlas; and "The World," a Classical Atlas. W. and A. K. Johnston, London and Edinburgh (*Publishers*). Native map of Chinese Turkistan (*Henry Kopsch, Esq.*). Map of Central Asia, by C. Ritter and F. Oetzel; Berlin, 1840; Map of Russian Turkestan, by Colonel Ilyin; Map of Russian Turkestan, by Captain Liusilin; and Map of Western Central Asia, by the Russian Military Topographical Depôt, 1865 (*Major-Gen. Sir F. J. Goldsmid*).

The PRESIDENT, in introducing the subject of the evening, said that both the papers about to be read referred to recent explorations in Central Africa. One was by Mr. Young, on his late sojourn on Lake Nyassa, where he had the honour of launching the first steamer that had ever appeared on that lake. Mr. Young had for many years been known to Geographers for his zeal and success in African travel. He had been engaged at various times in Africa, and the reputation thus gained led to his being chosen to take out the Free Kirk Missionary party in 1875 to found the settlement Livingstonia. The second Paper was on a new route and a new mode of travelling in Central Africa, which had been adopted by the Rev. Roger Price. The great difficulty in reaching the highlands of the lake regions had been the malarious and marshy character of the country for 100 or 150 miles from the coast. Burton, Speke, Grant, Cameron, Stanley, had all suffered greatly in health, and been frequently detained, before they could reach the highlands. A happy idea had led Mr. Price to discover a route comparatively free from these disadvantages, and he had marched his bullocks to the central plateau and back again in an unprecedentedly short time.

The following Papers were then read:—

1.—*On a recent Sojourn at Lake Nyassa, Central Africa.*

By Mr. E. D. YOUNG, R.N.

IN the month of June last year you did me the honour to lay before the Royal Geographical Society some brief notes which I sent from Lake Nyassa four months previously. I now avail myself of the opportunity furnished me this evening to give a more detailed account of the successful enterprise which I was privileged to conduct on behalf of the founders of the Livingstonia Mission, viz., the Free Church of Scotland. Although I shall endeavour as far as possible to keep within the limits which the objects of this Society impose upon me, I may, nevertheless, be permitted, I trust, to touch here and there lightly upon matters which were of all-absorbing interest to myself and my comrades, and inseparable from our motive in going to Central Africa. If I have specially to claim your indulgence for this in the course of a necessarily brief paper, I do it more confidently when I remember the large drafts made by this Society, from time to time, upon the knowledge gained by those who pass into hitherto unexplored lands, moved as they are to various efforts by the missionary spirit.

It is but a just tribute to the memory of David Livingstone, and a proper acknowledgment of the love of his countrymen towards him, to state that all that has been done upon Lake Nyassa is directly traceable to a determination to carry out the dearest wish expressed by the great traveller whilst he lived. He knew, and we who were with him knew also in the dark days of his disappointment, that to launch a steamer upon the waters of that splendid inland sea which he discovered in 1859, would do more to paralyse the appalling slave-trade carried on by Portuguese and Arabs in Eastern Africa than anything else. If he failed to convey the too cumbrous steamer *Lady Nyassa* across the Cataracts of the Shiré, his failure had this in it—it furnished me upon the spot with an experience as to what was possible and what impossible. Thus it enabled me to offer suggestions for another attempt in after years, which has proved, under God's good guidance, a perfect success. I need not occupy your time by describing the country bordering on the Zambesi and Shiré rivers. In passing, I may say that, since my previous visits, I found that an extraordinary flood, two years ago, had altered the course of both rivers at several points; but nothing materially interfered with our finding a convenient spot at the Kongoné mouth of the Zambesi, whereon to screw together the sections of the *Ilala*, nor to impede her passage to the foot of the Shiré Cataracts. It has already been recorded here with what enthusiasm the natives on the Shiré flocked from all quarters when the news spread that the English were once more coming amongst them. We could not pass the well-kept graves of Bishop Mackenzie, of Mr. Scudamore, Mr. Dickinson, and Mr. Thornton, without feeling at every step how the lives of these men had gone far to win this reception for us, and that, although dead, they still lived in the confidence, the joy, the ready help we met everywhere. The Falls of the Shiré may be said to extend for some 75 miles. They present the only obstacle to bar the passage of a small vessel from the ocean to Nyassa. But the obstacle is a formidable one. Within this distance the waters of Nyassa leap down a staircase of rocks and boulders for some 1800 feet. Moreover, it is necessary to traverse a most rugged road before traveller or porter can reach the higher ground. In our case, however, the difficulty most to be dreaded had no real existence. The Makololo, left on the lower river by Dr. Livingstone, and the men amongst whom the members of the Universities Mission lived, brought together an enormous concourse of willing porters, and in ten days we were enabled to take to pieces our steamer, to see her sections, boilers, machinery, and stores safely conveyed above the falls; to transport all our goods and baggage, and that at a very small cost and without the loss of a single article of any sort either by accident or by theft, though we employed 800 men. When I state to you that the carriage of these steel plates and burdens, averaging 50 lbs. weight a piece, necessitated some of the most tremendous exertion I ever witnessed, when one remembers that these faithful fellows staggered amongst rocks and stones, up hill and down hill, in shut-in gorges where the heat ran up to 120° in the shade; when one thinks of the heavy boiler and what it took to transport it, I think you will admit that the men who did this four days' work for six yards of calico a piece (say 1*s.* 6*d.*), finding their own food too without a grumble or a growl from first to last, are not to be despised. The work of reconstruction, after so much hard toil, tried our mettle in every sense of the word, and our health too, but it was accomplished and steam was up in the *Ilala* within a fortnight. Our first stopping-place was M'Ponda's village, containing a thousand huts or more. To my great delight I met Wakotani here, one of the native lads left in the country by Dr. Livingstone in 1866, and I am glad to say that during my stay on Lake Nyassa he made himself very useful to me. Not so welcome, however, was the presence of a number of scowling Zanzibar Arabs. There was something very significant in the way in which one of them pointed to the badge on my naval cap, and shook his head as he walked off with his comrades. We saw a number of slaves already pinned in the slave-sticks; and the character that M'Ponda's village bore, as the chief rendezvous of the slave-traders on the south border of Nyassa, was fully deserved from all we saw and heard. In spite of adverse influences at work, the chief gave us free leave to settle where we chose in his territory, and it was satisfactory to find that Cape Maclear, on which I had previously fixed my mind's eye, lay within it.

On the 12th October, 1875, we had steam up at daylight. I blew the whistle to attract the attention of the natives, who soon turned out in thousands along the river-bank. I sent a message to M'Ponda, asking him to take a short trip, that I might explain to him how the vessel moved; but he was too much frightened by what the Arabs had told him overnight: amongst other things, that our presence would cause evil spirits to enter him, that we should take his country away from him, and so forth. After making one or two runs up and down the river before all the people, we finally set off for the lake, accompanied by one of the chief's men and Wakotani. We entered Lake Nyassa at 7 A.M. There was a gentle breeze blowing, and the *Ilala* rode over the swell beautifully. Out of the fulness of my heart, I said "God speed you!" and "Amen" was the reply, I think, from all. We sang a hymn, and then held Divine Service; at the same time the *Ilala* was behaving beautifully, and doing her very best with a full pressure of steam. Coasting along the south-west shore, we examined numerous beautiful bays and inlets, but none afforded that shelter which was indispensable for our vessel in heavy weather. We called at Cape Maclear to wood, and found plenty of ebony, our principal fuel, some *lignum vitæ*, which burns better still, and hard woods of all kinds. An enormous population appeared in many places, but I found that the country had been much harried by the Ma Viti, a quasi Caffre tribe often mentioned by Livingstone and others, and who now are active in supplying the Portuguese of Tette with captives for the special interior slave-trade which is carried on by them upon the Zambesi. Marenga, an old friend of former years, and a powerful chief, had disappeared in the general turmoil. Passing on by M'Pemba, we sighted an Arab dhow sailing before us. As soon as the owners saw our flag flying, they lowered sail and waited for us to board her. I found no slaves, but only four miserable Arabs with a native crew; but the whole arrangements on board told too plain a tale concerning her calling. I found the owner could speak a little English, and that he hailed from Zanzibar. He fully made up his mind that the last hour of his dhow had come, but after a salutary warning I allowed him to pass on, not before he had questioned me as to how on earth we had been able to bring a steamer up from the sea, and had expressed a conviction that if the English could do this, they could do anything. We now steered a course E.N.E. across the lake, making for an Arab settlement at Loangwa; but here, too, we found that the place was destroyed by war, and that a powerful Ajawa chief, Makanjira, had dispersed the former occupants.

Leaving the Loangwa mouth, we steamed back to Cape Maclear, making a stormy passage, but at the same time developing the powers of our vessel in a heavy sea. It would be impossible to have a better sea-boat, and it was not long before we had to test her to the uttermost.

Arranging to settle, at all events temporarily, at Cape Maclear, we set about discharging stores, and were fortunate enough to find an anchorage just such as we desired, well protected from prevailing winds, and with good holding ground. It became necessary to return to the head of the Shiré cataracts to bring up a portion of our goods; I availed myself of the opportunity to pay M'Ponda another visit, and was received with a hearty welcome. He happened to be sober—a rare occurrence—and I found him exceedingly sensible in his remarks. He admitted what a great slaver he was, but stated that the sale of slaves and ivory was the only means by which he could procure clothes and necessaries from the coast. A large gang of slaves had just started, under Arab escort, to cross the lake. I may here mention that this simple avowal lies at the root of the whole of the East African coast slave-trade. Neither Portuguese nor Arabs will encourage any other trade. Slaves are bought with one hand, ivory with the other; the slaves carry the tusks to the coast, and there both are disposed of. Once let legitimate trade be stimulated by opening up communication by land and by water, so that the india-rubber, the metals, the gums, the cotton, the dye-woods, the ivory, the beeswax, the hard woods, which are to be had in this rich country, can be brought to ports on the coast, and the slave-trade will wither at its roots. We accomplished our trip without let or hindrance, and were glad to find those whom we had left at the station in good health. Time will not allow me to describe to you our daily life here; the insight we got to the native life, the intrigues of the slave-traders, nor the marvellous effect our presence produced on all sides, more especially in attracting to us from the four winds the scattered remnants of villages swept away by slave-raids. I hope in another form to preserve these details for the public, and I shall confine myself now to an account of our voyage round the lake, and the discovery of a large extension of its waters hitherto unknown.

We sailed from Cape Maclear on the 19th November, Dr. Laws of the Free Church, and Mr. Henderson of the Established Church of Scotland, accompanying me. Our first stopping-place was at Makanjira's on the south-east of the lake. My chief object in going thither was to gain permission from him, so that the mission represented by Mr. Henderson might be planted at the mouth of the Loangwa. Makanjira was very civil, and I found that, from having been at Zanzibar, he was well acquainted with the English. He is perhaps the greatest exporter of slaves to the coast of any one in these parts. Making our way northwards we came in sight of the grand range which towers over Chilowcela. In places the mountains run sheer down into the lake, and a short way from the shore we could get no bottom at 100 fathoms. For a long stretch it would be impossible even for a large vessel to find anchorage. We now reached Lesefa, which is the principal landing-place for slaves that have been transported by the Arabs from the western shores. Here too we noticed a sort of tacit understanding amongst the Arabs that the *Ilala* was the thin end of the wedge, and that sooner or later we mean to stop the traffic on this inland sea as we have upon the ocean.

At 3 A.M. on the 22nd, a furious gale sprang up. The *Ilala* dragged her anchors, and we had to get up steam and stand northwards; but so heavy was the sea, it became necessary to lie-to for four hours. As soon as it was safe to do so, we ran before the gale, and were "under water" for thirteen hours. At 5.30 P.M. we sighted a beautiful bay and found good anchorage. Still sailing northwards we passed the islands of Likomo and Chusamoolo. On our right an iron-bound coast stretched everywhere, save only when some ravine came down to the shore. In one spot we saw too plainly that a terrible massacre had taken place, for skeletons lay in all directions: we learnt that this was the result of a slave-raid on the part of the Ma Viti. It is their rule to slay every adult, without mercy, that is not fitted for the slave-market: in this case the captives had been disposed of to the Arabs. Here there is a subsidence in the mountain range, and the beautiful bays and inlets seem once to have been densely populated. Hardly any wood was to be procured in consequence of the forests being cleared, but now the only remnant of the people was found on rocky patches jutting up from the water of the lake, and on singular "pile villages." We found that the poor creatures had conveyed earth in their canoes to these rocks, and wherever a crevice afforded a hold, there would a little patch of cassava or corn appear, grown with infinite labour. The platform villages to which we came soon, were exceedingly interesting. For the most part they are built 300 or 400 yards from the shore, and in from 8 to 12 feet of water. Poles are driven down in rows: on the top of these a wooden platform is constructed, and this is the foundation or floor of the village. To give some idea of the extent of these, I may say that one consisted of about 100 huts. With an abundance of fish around them the islanders hold their own against starvation. On the 25th, without any warning, a furious gale arose and a sea quickly got up that one would only expect to meet with on the Atlantic. I now began to see why Livingstone spoke of it as the "Lake of Storms." We nearly came to grief in our attempts to get more sea-room, for a deluge of rain falling upon the boiler at the first onset of the storm, condensed the steam so that the *Ilala* would not answer her helm. However thankfully enough we got her head off shore, and stood away for the night. It rained hard and blew heavily, the ship labouring and all hands wet through and through. In the morning the weather moderated, and we stood in for the land.

We were now abreast of some mountains that, amongst the parallel ranges which virtually make a mountain-basin of Lake Nyassa, exceed them all in stupendous grandeur. In no part of the world have I seen anything to equal their peculiar magnificence. With peaks apparently 10,000 to 12,000 feet high, they run perpendicularly down into the lake. We got no sounding close under them at 140 fathoms. The rain was pouring upon them, and numberless waterfalls hung like threads of white floss-silk from crevices which ran out upon their sides far up among the clouds. Baffled by the raids of the Ma Viti in 1866, Livingstone could not induce his men to go with him to the north end of Nyassa, and thus he missed seeing that which would have struck him as the most beautiful feature of "his old home," as he called the lake. There was but one name to give to these mountains. At its northern end they stand like portals to the lake, faced by the opposite mountains: and as future travellers look on the "Livingstone Range" it may aid them to remember the man who, during his life, more than any other, added to our knowledge of the hitherto unknown beauties of the earth.

There is a gorge trending in an easterly direction from the head of the lake, filled by a wide marsh: for the two ranges are protracted northwards, and appear to overlap at some considerable distance off. The mouth of a river—apparently a wide one—was visible; but it was necessary to continue our voyage, as there was no shelter and we were on a lee-shore. As it was, we cast anchor and took our chance. At sunset a desperate gale sprang up, and, with both anchors down and steaming to them, we expected to go ashore every minute. After the greatest peril we succeeded, thanks to a shift of wind, in getting to sea, and for three days and nights, in the most fearfully wild sea and raging storm, we laid-to, under jib and mainsail, drifting in a southerly direction. It was not advisable to steer again for the marsh we had so lately seen in such weather, for no shelter could be procured in its vicinity. I learnt from the natives, when next we made the land on the north-west shore, that a River Rovuma or Röoma flows out at the extreme north. I think this is so for the following reasons:—

In the first place, Dr. Livingstone heard the same story twenty years ago, when he discovered the lake, and in quite a different quarter. Many here will remember how sanguine he was that the Rovuma River, which debouches on the east coast, was identical with this Nyassa River, and that it would prove to be a second outlet. It may yet prove to be so, though it is only right to add the discovery can be of little use, for the Rovuma River ceases to be navigable a short distance from the sea.

My second reason for believing the native report is (and, let me add, the people had no reason for deceiving us) that in this stormy time it was very easy to see where rivers ran into the lake. A long current of muddy water would trail out on the dark-blue surface; here, however, at the Rovuma, there was nothing of the kind, and it seems conclusive, therefore, that no inflow exists.

We cruised with a southerly course along the western shore. Here, whilst one does not find such an iron-bound coast as during the 50 miles run along the base of the Livingstone Range, a peculiar delight is felt in studying the exquisite park-like glades which lie between the mountains and the shore. The herds of game merely looked up as we passed, just as sheep raise their heads to gaze at the train, and then went on browsing. In one place a most remarkable detached mountain appears, which I have named Mount Waller. It stands quite perpendicular for, say, 4000 feet. The top is flat, and the sides give it the appearance of a pyramid from which a large slice of the top has been removed in order to place in position a perfectly square block of a greenish colour. Beneath this singular summit there is a deep horizontal band of white stone or quartz, succeeded by another of clay apparently, and then comes one of intense black, possibly coal, for this mineral is known to all the natives. No regiment of Pharaoh's could have studied effect more carefully or insured in the centre of Africa a more singular and gigantic wonder.

After a further cruise, we reached that part of the western shore which was known to Livingstone, his brother, and Dr. Kirk, in 1862. Making for the islands of Chisomoolo and Li-Komo, we were able to dispel a pre-existing notion that some sort of a ferry was to be found in this direction. In one place only, and then for no great distance off shore, is there anything like shoal water. Lake Nyassa is a prodigiously deep inland sea, on which no small craft would stand a chance. When islands do appear above the water, they are the topmost crags of submerged mountains descending almost perpendicularly. Great islands of reeds and grass are from time to time driven away by fierce winds from their birth-place at the deltas of various rivers running into the lake. These get stranded on these peaks, and thus islands dot the surface in places. In sailing across from west to east, another terrific storm caught us. At one time, in the middle of a thunderstorm of great fury, no fewer than 12 waterspouts appeared at one time around us: we had literally to steer hither and thither to avoid them, for had one overtaken us it would have sent us to the bottom without a doubt.

Likomo is a large island, an exception to the rule. It is thickly populated, and extremely fertile. It contains a land-locked harbour, and is within easy reach of the shore. We were well received, and left the islanders delighted with our stay. To the Arab settlement of Kota Kota was our next cruise. This is the great exporting place for slaves, who are sent eastward. I came across my friend of the other side, who had arrived in his dhow. Able to speak English, and not above making a clean breast of things, I learnt from him that the annual traffic might be reckoned at some 10,000 slaves. It may be asked why did not we interfere with these men during the transit of these slave laden dhows. I can but say I was acting up to instructions, which very properly forbade me to do anything of the kind while planting these missionary stations. Situated as I was, it became policy to shut one's eyes to a good deal; in fact, it would have been impolitic to take the *Ilala* again to the north of the lake after we regained Cape Maclear, because had we sighted one of these dhows again without taking notice of her occupation, it would have been assumed either that we did not, as English people, intend to interfere with the slave-trade at all, or that we were afraid to face them. As it is, the Arabs fully believe that we have taken possession of Lake Nyassa, and that their trade in human beings is about to be stopped: I only hope that they may prove right in their predictions. To detail to you the further progress of the *Ilala* toward Cape Maclear, our life there, the arrival of another large party under Dr. Stewart, the present head of the Mission, would only be to aggravate the offence I have committed in taking up so much time. I have related how the first steamer was placed on an African lake, and, with a thankful heart to Him who watched over us so mercifully, I pray that He may be pleased to turn her presence on Lake Nyassa to His wise purposes in the efforts of His servants for the regeneration of our poor oppressed fellow-creatures.

MR. YOUNG said he wished to make one fact public which was not in the Paper, referring to the great Ma Viti tribe, which had been the curse of the interior of Africa, and had almost depopulated the district between the sea and the Lake. Dr. Livingstone was desirous of getting hold of these people, but failed to do so. Before returning to England, however, he (Mr. Young), single-handed, met 300 of the warriors of that tribe, and made a treaty between them and the Makololo. The Mission was also the means of stopping a war between the Makololo and the Ajawas, and now they are great friends. Everything out there now looks very encouraging; and now I say "The land is before you; go in and possess it."

2. –*A New Route and New Mode of Travelling into Central Africa, adopted by the* Rev. ROGER PRICE *in* 1876, *described by* Rev. JOSEPH MULLENS, D.D.

THE travellers who have journeyed into Central Africa from the East coast and the neighbourhood of Zanzibar have been called to encounter difficulties as formidable as may be met with in any part of the world. These difficulties have caused not only peril to health and severe trials of patience, but have occasioned them unusual expense. One object which most of them have kept in view was to reach the line of the three great lakes, and pay a visit to Ujiji.

The distance between Ujiji and the coast is measured pretty exactly by nine degrees of longitude (30° E. long. to 39° E. long.); and the journey from Zanzibar to the Tanganyika Lake may be divided very neatly into three stages of about three degrees each. The first stage carries the traveller to Mpwapwa and Ugogo; the second to Taboro or Unyanyembe; the third brings him to the Tanganyika shore. The distance (as the crow flies) is about 620 English miles; the travelling distance is just over 700. Very few have accomplished the journey under 1000*l.*; some have paid for it a great deal more. The experiences of the distinguished men who have hitherto performed it have proved of unusual interest. Burton, Speke and Grant, Livingstone and Stanley, and

Captain Cameron and his companions, have made the route and its incidents familiar to all students of geography; nor has the youngest and latest writer of the series fallen behind his predecessors in the clearness, simplicity and judgment with which he has told his story.

So far as the *country* is concerned, the principal difficulties lie within the first section of the journey, the district between the sea-coast and Ugogo. About 200 miles in breadth, this district is divided into two portions of a hundred miles, each having its own character. From the coast at Bagamoyo, for the first hundred miles the land is in general level, until it reaches the roots and spurs of the hills; it then exhibits small enclosed valleys, with streams feeding the Wámi River, and causing numerous swamps and pools. The vegetation consists largely of brushwood, and of small forest with tropical plants and trees. A hundred miles in the interior the ground has begun to rise, and to exhibit lines of hills with parallel valleys, more or less regular, having a general trend to the N.N.E. These the traveller crosses, now mounting a high granite ridge, then descending; mounting higher, and descending a little again. In this way he crosses the broad swampy valley of the Mukandokwa or Makata River, passes the little Lake Ugombo, in which it rises, and winding among the noble hills of the Usagára Range, arrives at length at Mpwapwa, on the upper plateau, 3300 feet above the sea. Thence westward the journey is more easy. Passing through a gap in the Rubeho range, the caravan traverses vast rolling plains, with granite knolls covered with wood, with here and there forest, here and there thinly-scattered villages, and but few streams. At the end of the second two hundred miles it reaches Unyanyembe. Still journeying somewhat north-west over the rolling hills and the heads of valleys which trend to the west, the traveller comes to the inner edge of the high rocky level, and descends 800 feet to Lake Tanganyika, and the town of Ujiji on its eastern shore.

The difficulty and danger connected with disease arise from several causes, and are unusually great, especially between the sea-shore and the hills; while the effects of that first stage on the traveller's health frequently follow him and his people far into the interior. The natives suffer greatly; even Englishmen get fever—can get it often; and in several cases it has sooner or later ended in death. The steaming districts near the coast, with their swampy pools, doubtless abound in malaria. The water in many stopping-places is more or less poisoned from the same cause. The usual camping-grounds, occupied again and again by large bodies of bearers and slaves, are rendered unfit for tent-life. And rank vegetation, lines of rock and hill, may shut out those healthy breezes by which alone these poisonous exhalations can be driven away. But, in my judgment, the most frequent cause of fever on these long journeys is the great change in temperature between the heat of the day and the cool evening which rapidly follows. During the first hour after sunset the fall in temperature is very decided. Englishmen and natives arrive hot and exhausted, their clothes wet with perspiration, and the change in temperature, often increased by the strong south-east winds, soon becomes dangerous. A severe cold or attack of fever may speedily follow. The Englishman may guard himself by warm dress and hot coffee; but the native has few resources of the kind at his command, and is careless of using what he has.

The principal difficulty of African travel has, however, not been either the road or the fevers: it has been connected with the system of carriage. From the day when the ivory-trade of Zanzibar grew strong, and transport from thence to India, to the Persian Gulf and Aden, became easy and frequent, the slave-trade received a powerful stimulus, and gangs of slaves were made almost the only means of carriage. Hitherto all the English travellers in East Africa have been dependent upon these human bearers. From Burton down to the Church Missionary Expedition, which left the coast a few months ago, every one has been compelled to employ them. And the trouble they have caused by their fickleness, their dishonesty, their bodily weaknesses, their indolence, their diseases, and numerous deaths, has been indescribable. No one can read the experiences recorded in travellers' books without feeling the deepest indignation against these fickle men, and the profoundest pity for the traveller whose patience was so tried. No one who has read Captain Cameron's book will forget "Bombay." Where, at times, as many as three hundred such men have been taken in a single party, who can wonder at the worry, the detention, the waste of time and trouble involved in gathering them, keeping them together, fetching back runaways, starting them, bringing in stragglers, replacing the incompetent, and humanely caring for the whole? The outlay in wages has always been great, but property stolen, flung away by bearers, or left behind by the travellers for lack of men to carry the packages, has been far greater. The losses incurred in this way by every expedition have been exceedingly great.

Reflecting on these things, the Directors of the London Missionary Society, when planning their expedition to Lake Tanganyika, thought it worth while specially to inquire into two points: (1) Could a route be found to the north of the Wámi River, on higher ground, and free from the swampy levels found here and there on the road from Bagamoyo? and (2) Was it possible to employ on the entire line the waggon drawn by bullocks, so common in the colonies of South Africa, and that without risk from the tsetse-fly? And as the Rev. Roger Price, who has had long experience of roads and waggons in South Africa, was then in England, they requested Mr. Price to proceed to Zanzibar to make these inquiries on the spot. The following is a brief outline of Mr. Price's proceedings, and of their result.

Mr. Price arrived at Zanzibar on May 2nd, 1876, and, having gained much information bearing upon his purpose, he resolved to pay a preliminary visit to Sadáni, on the African coast, and confer with Bwána Héri, the chief of the district, respecting a journey into the interior. His reception was everything he could desire. The chief entered heartily into the project, accompanied him to Ndumi, an excellent starting station, six miles from the coast, and promised a guide who knew the road. He assured Mr. Price that no fly was known on that road which killed bullocks, and that cattle were frequently brought down to the coast from the interior. The arrival of an ivory caravan from near Unyanyembe proved that the route proposed was actually in use, and the information derived from its people implied that it contained no special difficulties.

Mr. Price at once, therefore, proceeded to make preparations in Zanzibar for travelling into the interior as far as Mpwapwa, and examining the route for himself. He procured a select band of thirty bearers; purchased a supply of cloth and beads, to use as money; and endeavoured to obtain some kind of carriage with which to try his experiment. The Banyans at the Custom-house kindly gave him a cart, which, however, required extensive repair; and then he set to work to train bullocks. His experiences were somewhat amusing. He says:—

"Then came the oxen: the renowned French Charlie seems to be the only dealer in ox-flesh at Zanzibar. Accordingly, Mr. Donaldson and I proceeded to his place to see if we could get a pair. I had been told to expect difficulties here. It was evidently a puzzle to Charlie what anybody in Zanzibar should want with live oxen; and he had a strong suspicion that I was going to set up an opposition butcher's shop. He strongly recommended *mouton* and *mbuzi* (Swahili for goat); but for some time he could not be persuaded to part with any of his beeves. At last he seemed quite convinced that I had no intention of interfering with his trade, and he would let me have two oxen, or four, or as many as I liked.

"The first ox was caught and led out, and made fast to a pole. The second proved to be a Tartar. He seemed quiet enough to look at or even to pat; but once the rope was round his horns, he began to show his mettle. We got him outside the kraal, but he did not remain there long: he made a jump over a railing that was ever so much higher than himself, breaking the top rail right off, and went back into the kraal in triumph. This was too much for Charlie altogether. 'That ox no do, gentlemen' (I was alone). I selected another: he was more reasonable; but I had to be satisfied to let them run loose through the street, till we got on the flat. There we caught them and put on the yoke. The one (Wales) took kindly to the yoke; but the other (England) was very stubborn, almost to the extent of lying down and refusing. After a good deal of the usual manœuvring in such cases, and a kindly and judicious use of the cane, we got England to carry the yoke with Wales. As usual at that time of the evening (five o'clock) there was a large concourse of people on the flats, who looked on with much curiosity. After some rough handling, England and Wales submitted to carry the yoke through the street into their kraal. Next morning I went to give them their second lesson, and then went out as far as Bishop Steere's place to get the bough of a tree for the oxen to pull. When England and Wales had in the course of four days got to pull pretty well, I ventured to catch a third ox. Scotland was wild and rebellious, clearing the street as I passed along; but once outside, and the yoke fairly on his neck, and the bush behind him, and with Wales as a mate, he set to work at once, and has not given much trouble since."

After training a fourth bullock, and exchanging an indolent ox for one more spirited, on June 2nd he says in his journal:

"To-day, both morning and evening, I have had my complete team of four in the little cart. This morning I drove out to Bishop Steere's place, my Kilangózi and myself in the cart. The Bishop and several of his party came out to see my little turn-out. Everything about it was closely observed, as the Bishop has quite an idea of waggons and oxen for Eastern Africa. The Bishop again congratulated me on the success which had so far attended my efforts. Asmáni was evidently not a little proud of his position beside the Mzungu (the Englishman) in the cart, and received with much satisfaction the acclamations of his numerous friends and acquaintances along the roads, who shouted, 'That's the way you are going to take the Mzungu to Unyamwezi!'"

At the last moment the bearers began, as usual, to give trouble. But decision and good sense, and the confinement of their leader for three days in the Fort prison, reduced them to submission; and they proved in the end an orderly and willing band of men. A four hours' sail, with a fine breeze, carried the whole party across the water, from Zanzibar to Sadáni. The last preparations were made on the 9th of June, and the next morning the little expedition started for the interior. It included thirty men, all told, four oxen, a riding-donkey, and the cart; and as the caravan belonged to an Englishman, and contained some novel elements, the entire community of Sadáni assembled to see it start. The chief, Bwána Heri, expressed unbounded admiration of the cart arrangement, and was attentive and hospitable to the last. Mr. Price started on the 10th of June. In nineteen stages, long and short, occupying twenty-six days, he reached Mpwapwa, two hundred miles away, within the upper edge of the great plateau. He occupied only a fortnight in the return trip; and completed the entire journey of 400 miles, bullocks and all, in forty-two days. It is not necessary to tell the whole story; a few notes on special topics connected with the journey will suffice; and, naturally, the geography of the district occupies the first place.

Six miles from the coast, and lying due west from Sadáni, is the village of Ndumi. It stands on the summit of a knoll, which forms part of an elevated terrace or belt of country, which, from the sea-shore, has the appearance of a range of hills, and stretches north-east and south-west as far as the eye can see. Opposite Pemba this terrace juts into the sea. The route to Mpwapwa lies right across it; and the consequence is, that on that route the ground begins to slope upward at once, and the traveller loses swampy ground six miles from the coast; whereas, on the Bagamoyo road, he keeps on the low land for several days, is detained on that unhealthy district by troubles with his bearers, and suffers more harm there than almost anywhere in his onward journey. The ground between the coast and Ndumi is tolerably level; the only difficulty in the way of a road lies in the forest, grass, and jungle, which need to be cut away. A noble baobab-tree, on the summit of the little hill, renders Ndumi a conspicuous object.

Mkangé is one of many villages situated in a fertile valley, through which runs a fine stream of water. Mkuru is buried in the depths of a dense forest. So far the cart got on well. Beyond this place it caught on a stump; the body and wheels came to a stand, and the oxen tore the front part and the pole completely away. Mr. Price therefore resolved to leave the cart behind, and to take the oxen on alone. Crossing over a succession of rolling ridges and little valleys, crossing the Rukigura, which flows from the north, passing three conical hills in the valley to the south, and Kanga Peak to the north and west, the little party came into the valley of the Wámi, some 40 miles north of Simbamwemi, on the Bagamoyo road.

At Kidúdwé Mr. Price entered the Nguru district, and soon reached the main granite range, which, in East Africa, forms the outer edging of the vast interior plateau. The Nguru Range is in reality the northern continuation of the Usagara Mountains, so wonderful in their grandeur, and so precipitous to climb, to which all the African travellers refer. Inside the Nguru Mountains, to the westward, is a range of detached hills—the Kaguru hills, amongst and beyond which live the Wakaguru and Masái. Here there is a remarkable gap in the granite masses, several miles wide, on each side of which the ranges appear as vast mountain-walls; and the new route passes between them to the west, the Nguru hills being about 6 miles distant on the north side. The broad valley between is wonderfully fertile. Villages and stopping-stations are numerous. Several streams from the northern hills flow through it down to the Wámi. The people are gentle and peaceable, and the country possesses abundance. The corn grows to a height of 16 feet, and the sugar-cane runs wild into jungle and forest. On the mountain-sides feed flocks of sheep and goats; to the north are large herds of cattle. It will be remembered that in South India there is a similar gap between the south face of the Nilgiri Hills and the north side of the Anamulli Range, and that the Madras Railway goes through it to the west coast on level ground, with a principal station at Palghaut, from which the gap is named.

Towards the west end of the gap the country becomes rocky, and still ascending, presents steep and rough hill-scarps, with narrow and deep valleys intervening. This is followed by a long stretch of comparatively smooth country; but for 20 miles it is uninhabited, and the district abounds in game. At Magubika steep descents and ascents again occur, and for a short distance the country looked hopeless for a waggon-road; but it proved the last of the difficulties. The party were near the edge of the plateau, and smooth easy country immediately followed. Mr. Price describes Kitángi as a beautiful spot. "Emerging from the pass, we gradually rose for about 4 miles, when there opened out to us, the most cheering sight I had yet seen in East Africa. To the southward lay the great Usagára Range, with a long gorge leading up into the very heart of the great mountains, which seemed piled up one behind another as far as the eye could reach. Through this gorge comes out the beautiful stream which gives its name (Kitangé) to the district, and which forms its principal water-supply, although there are several other smaller streams. To the northward, and round to the west and south-west, are high ridges and detached hills; the whole enclosing a basin about 10 miles wide. The whole of this was covered with a fine and comparatively short grass, such as I had often seen in the great pasture-lands of the south. There was but little bush except along the course of the ravines. The large spreading mimosa, growing in its usual fashion, here a solitary tree, there a clump of half-a-dozen, gave to the open parts of the basin quite a park-like appearance. As this lovely scene was viewed from the height which we had attained, I could not help saying to my South African servant, 'Oh, that I had a waggon and a span of oxen now, and a proper African whip!' As might be expected, when we descended into the Kitangé basin, considerable flocks and herds began to appear. But what was most interesting to me, was the sight of the villages with which the whole of this great basin was dotted over. Look wherever I would, I could not fail to discover several of these, often within rifle-shot of one another. Up the sides of the great mountains, on both sides of the Kitangé gorge as far as the eye could reach—east, west, north, and south—they were to be seen. The villages are mostly of the Tembé kind. This mode of building seems necessary in this part of the country, where they have none of the protection afforded by the thickets nearer the coast. One of the saddest features of the state of things in East Africa is the constant fear which the people have of being attacked. It is a rare thing to see a male above the age of twelve or fifteen, by day or by night, in the town or out of it, without arms of some kind."

From Meomboni, a pool near the top of the Kitangé ridge, the route lay across an immense flat, with very little water, and nights that were very cold. In the early morning the thermometer stood at 45°. Hence in two stages the party reached Mpwapwa. This station is well known to African travellers, and has been specially described by Mr. Stanley.

In enumerating the difficulties of this route for waggons and oxen, Mr. Price specifies the long thick grass, so abundant near the coast. Cornfields spread out around the village, and it is difficult to avoid them. The jungle and forest are usually thin, except in certain limited spots, where a few men with good American axes would soon clear the way. Some of the ravines and gullies look ugly enough; but spades and pickaxes will render them passable. There are three rivers, or rather mountain-streams, on the route, which will give trouble when swollen by the rains; the Rukigura, the Mvue and the Mkindo. But waggons starting from the coast in July would probably find all these rivers fordable. The hill country is a difficulty; but to an old South African it is nothing formidable. "On the entire route there is not a place to compare for difficulty with roads which the colonists pass daily: and the ordinary road between Graham's Town and Algoa Bay is more difficult than the route which I travelled in going to Ugogo. Every bit of hilly road between Sádáni and Mpwapwa put together would not amount to more than 20 miles." As to the difficulty most feared of all, the tsetse-fly, which seems to be a trouble on the Bagamoyo road, he says: "I regard the absence of tsetse between Saadáni and Mpwapwa as settled. I took the four bullocks with me the whole way, and left them at Saadáni on my return, apparently in perfect health. Cattle, sheep and goats are to be met with here and there along the whole route." Dr. Moffat gives it as his experience that it is the increase of population which destroys tsetse. And it may be that the occurrence of the gap in the new route, with its fertile level, its numerous villages and broad cultivation, and the general population along the route, explain the difference in this matter between the jungly, mountainous and ill-peopled district to the south, and the more open, dry and cultivated route to the north of the Wámi River.

In regard to the results of this pioneering journey, Dr. Kirk, living on the spot, and discerning the full value of an improved method of communication, writes to Lord Derby in very warm terms. He says: "Mr. Price's journey has been in every way successful, and he returns prepared to give a most favourable report on the road, the country, and the temper of the people among whom he passed." After giving some account of the journey, he concludes his despatch by saying: "I have thought the above sketch of his proceedings may not be uninteresting to your Lordship, as indicating a practicable means of developing at once the resources of the interior, in a way that, so long as every article sold or bought had to be carried by porters, could never have been done."

Agreeing heartily with these views of Dr. Kirk, and convinced that there is solid ground for believing the old plans of South African travel to be perfectly applicable to these new regions in

Central Africa, the Directors of the London Missionary Society are now fitting out their expedition to Lake Tanganyika on the basis suggested by Mr. Price. Containing five or six Englishmen, its equipment will consist of two waggons and eight carts, covered with waterproofs; teams of twelve oxen for the waggons, and six for each cart, with a small reserve, will make up a body of eighty oxen, of whom it is desired that a portion shall be obtained from among the well-trained oxen of Natal; yokes, waggon-gear, and some Kafir drivers and leaders will also be sought in Natal. Tents for camping, stores for a period of two years, a fair supply of barter goods, beads and wire (partly for payments on the road and partly as money at their final destination); a good supply of tools for workshops and industrial schools; also of medicine for a dispensary; as well as of seeds of fruits, vegetables, and grain, are now being prepared as outfit for the expedition. It is expected that they will only spend the month of June on the sea-coast, and that with July the waggon-train will commence its march into the interior. Time, thought and care have been devoted to these preparations, because the importance of the experiment is perceived, and all concerned are anxious that it shall prove a complete success.

If this expedition, and that of the Church Missionary Society which has preceded it, merely contemplated a visit to the Lake Region, they would excite but a passing interest. But times have changed with Central Africa. The experiences and revelations of each new traveller have deepened the interest felt in its truest welfare, until all classes of Englishmen are anxious to see its tribes protected, delivered from the wrongs from which they have suffered, stimulated to industry, enlightened, taught, and civilised. These expeditions are but precursors of a strong stream of civilising and beneficial agencies, which will continue to flow into this great region for many generations to come. Those agencies are of many kinds. These ignorant and injured races in the interior need the doctor, the surgeon, the skilled artisan, as well as the missionary and the teacher. The honourable trader is needed to help them in exchanging their native produce for English money and English goods, that their energies may be stimulated, and their resources increased. We have, therefore, to contemplate the permanent residence of Englishmen in the interior, and, with their residence, that continued elevation of the social condition of the natives, and that continued exposure of wrong-doing, by which our right-minded countrymen, travellers, traders, colonists, and missionaries, have conferred such great benefits upon many nations of the world.

To secure this safe and permanent residence, and with it the enlargement and increase of honourable trade, it appears to me that two things are necessary; the formation of a direct road, and the establishment of a line of stopping-stations. These measures are essential to the success of everything else, and with them other measures will move forward rapidly. Presuming that the waggon-train will be found to answer, so far as we at present know, the northern line of route visited by Mr. Price is not unsuitable in itself, and is a route free from the tsetse. It is specially suited to Englishmen, because it soon runs over rocky ridges, and is open and free of swamps. At the very outset the town of Ndumi, 6 miles from the sea-coast, is on the edge of a high terrace. A good road to it, which could be made with ease, would carry a traveller, his goods and waggons, at once away from the low level near the sea; at Ndumi he could make his final preparations in comfort, under circumstances very different from the heat and swamp of Bagamoyo. The expenditure on such a road would depend upon the degree to which natural inequalities in the ground are levelled, and forest and jungle are removed. Quite as important as the road is the subject of stopping-stations. A waggon-train carrying valuable goods, with few men, needs protection at night; the oxen need to be preserved both from straying and being stolen. In South Africa the straying of oxen at night is the cause of endless anxiety, detention and worry. What so useful for this protection as the serái of Northern India? A small outlay of money would without difficulty provide a series of seráis, at intervals of 20 miles, which would bring a trader or traveller to Mpwapwa probably in fifteen to twenty days, into a region with dry healthy air, and moderate heat, where he could live in comfort. Mpwapwa itself, or some new place near, might be made an important head-station; and, having its base at Saadáni and a good road from that place, would be both a secure and profitable place of trade to English merchants. It stands at the point where two or three lines of roads from the coast meet together. A great portion of the trade of the interior passes through it, and Mr. Price points out that "many a caravan, especially the purely native ones, which now go to the coast to be taxed and fleeced right and left, would hail an establishment at Mpwapwa where they could get what they wanted, and would gladly avoid the difficulties between that place and the coast." The system of seráis would scarcely appear strange to the native tribes, for their own *tembes* are seráis on a larger scale, constructed in much the same fashion, and having the same security in view.

It seems to me that it is in this first section of the long journey to the lakes that the traveller, at the present time, specially needs this kind of help. Make easy the route for his waggon-train so far; place him without an hour's delay at Ndumi on rocky land; beyond that point give him the stopping-stations, where his cattle and his goods shall rest in their journey, secure and well supplied; carry him by these means speedily across the lower or fevered country on to the healthy plateau; and already you have solved one of the greatest difficulties in the long journey that lies before him. In due time let the same be done for other chief stations and smaller resting-places, in the second and third stages of that journey. The trade will soon change hands, and a healthy reform in the present method of intercourse and traffic, tantamount to a revolution, will bring the heart of Africa near to Europe, and will bind it in closer bonds to the whole civilised world.

Captain WILSON, R.N., said it might not be generally known that Mr. Young began his African career with Dr. Livingstone in 1862, by commanding the *Pioneer*, the vessel which was placed by the Foreign Office at the disposal of Dr. Livingstone on the Zambesi. Mr. Young remained in command there for two years, and acquired a great deal of experience. After that, in 1866 or 1867, the report came home that Livingstone had been killed near the south end of Nyassa. The Government of the day did not believe the statement, and Sir Roderick Murchison induced them to send out an expedition under Mr. Young to ascertain the truth or falsity of the rumour. That expedition returned to England with the news that Livingstone had passed on beyond the place where he was supposed to have been killed. When Mr. Young came home he was very properly rewarded by the Admiralty with an excellent appointment in the Coast Guard, where he lived until Livingstone's remains were consigned to his last home in Westminster Abbey. Several African friends then met together, among them Dr. Stewart of Hopedale, now at Lake Nyassa, to consider the practicability of carrying out Livingstone's wish and establishing a Mission on Nyassa. Dr. Stewart asked Mr. Young to become the leader. Mr. Young consented. They then went to Scotland, and called together two or three meetings. The Scotch were a practical people, and at the end of a little discussion the idea was approved of. In a very few weeks 10,000*l.* were subscribed. In six weeks from that date the steamer was built. She was a vessel of about 25 tons displacement, 47 feet long, 12 feet broad, drawing 5 feet 6 inches of water, a good sea-going boat, schooner-rigged, and a very fast steamer. She was put together with nuts and screws. Mr. Young left England in May, and by October he had got his steamer conveyed past the Murchison Falls, and was steaming up into Lake Nyassa. From the sea to the Lake looked a mere hop, skip, and a jump on the map, but in reality, owing to the meanderings of the river the distance was upwards of 400 miles, and having himself pulled up to the foot of the Falls, he knew what difficulties had to be encountered. Mr. Young had treated them as a mere bagatelle; but if the difficulties on the Lake were much greater than those on the river, they must be quite as much as any ordinary man could overcome. Mr. Young carried his 40 or 50 tons of goods past the Rapids, put his steamer together a second time, launched her on the Lake, and circumnavigated it. There were one or two matters which Mr. Young had not referred to, but which deserved prominence. At two or three different points on the lake large numbers of cattle were seen. Opposite one of the islands there were no less than 200 head. Another fact, showing the enormous importance of Lake Nyassa, was that five large dhows were seen there. A dhow was a vessel of considerable tonnage, and he was not aware that in any other part of the large lakes of Africa anything larger than a canoe had ever been found. The five dhows were probably not less than 300 tons burden, and there must, therefore, be a very large trade in those parts. The Mission was no ordinary assemblage of Church people; it was a real, substantial, practical Mission. Every man who had gone out was a double-handed man, able to work as well as to preach. There were carpenters, blacksmiths, agriculturists, sailors, carefully selected for the work, so that they might teach some useful occupation to the natives. But Mr. Young did not only establish a Mission, he founded a Colony; and at Cape Maclear there was now a colony fairly started. Houses had been built, a fort erected, and a slip formed for hauling up the vessel and repairing her. A large water-way had also been cut to let the water out from the plains, so that the crops should not be destroyed by the inundations. For the eighteen months that Mr. Young had been there his sense of duty was such, that he never slept one night out of his little steamer. With reference to the second Paper, it was most desirable that an overland route should be formed; but if the Zambesi could be opened to free trade, no overland route would be able to compete with it. The writer of the Paper had stated that it cost 1000*l.* for each traveller who crossed from Zanzibar to the Tanganyika; but the expense of placing the steamer on Lake Nyassa, sending out eight persons, and maintaining the Mission for one year, was in round numbers only 4500*l.* From the north end of the Lake to the sea, there was water-carriage for at least 700 miles, while from Tanganyika to the north of Nyassa there would be only 180 or 200 miles of land-carriage. By the overland route, on the other hand, there were at least 700 miles of land-carriage to the north of Tanganyika; while by the Zambesi route there were 1200 miles of water-way, and only 250 miles of land-travelling to the same spot. It seemed to him that the natural outlet of Africa on the East was by the mouths of the Zambesi, and the efforts of this country should now be directed to opening up that river to free trade. If that was done, the slave-trade of course would cease. The slave-trade was necessary in a country were there was no animal carriage. The ivory must be carried to the coast, and for this purpose slaves were employed; but if water-carriage were obtained, the whole difficulty would be solved.

The PRESIDENT said it was interesting to see how, in this age of progress, things were accomplished in the course of a few years, which formerly used to require centuries even to mature the thought of action and a practical issue. The description of the foundation of the Mission on Lake Nyassa was more like the old stories of the Moravian missions, than of a mere missionary enterprise, because it involved the teaching of trades, and the carrying on of all the practical arts of life and civilisation. Mr. Cotterill, a son of the Bishop of Edinburgh, was already going over the same ground; his object being to see whether, by establishing a legitimate trade, a blow might not be struck at the root of the iniquities of the slave-trade. Every Englishman must feel the greatest interest in the enterprise, and wish it success.

The BISHOP OF EDINBURGH said, according to the last account, his son had only just reached Nyassa, and therefore nothing was yet known of any experience he had gained in regard to the object which had taken him out to Central Africa. He did not go out as a trader himself, but to discover which were the best channels for trade, and what were the best products of the country. He was intrusted with a certain amount of goods by merchants, both in Scotland and England, not with the idea of gaining any profit by the adventure, but only as an experiment. No one knew better than Mr. Young that it was utterly hopeless to expect to make a profit until the Zambesi was opened for free trade. He did not think there was any objection to his mentioning that his son obtained, through the Foreign Office, from the Lisbon Government, a free pass through their territories in Africa, on the understanding that it was to be an experimental expedition; but, instead of having free passage there, he was charged 26 per cent. on the goods that he was taking out, and his diaries showed that every possible obstacle was thrown in the way of his progress by the Portuguese officials there. At Lisbon, he believed, the authorities disowned any complicity with the slave-trade, and no doubt they were not aware of what was going on, but it was certain that the Portuguese officials in Africa encouraged the slave-trade. Mr. Young had referred to a trade in slaves with Tete on the Zambesi, and he had heard from his son-in-law, who had explored the Matabele country, that slaves were sent down there from the Portuguese settlement at Tete, and that he had seen the slaves himself. There could be no doubt that the Zambesi and the Shire were the natural outlet for the trade of the Nyassa district, but there were still several difficulties to be overcome. He thought it was a great mistake to go to Quillimane at all. Some people seemed to imagine that the Quillimane was one of the mouths of the Zambesi, but for a considerable part of the year, as was shown by a map which his son had sent home, the Mutu, a branch of the Quillimane, did not communicate at all with the Zambesi. The members of the Expedition were detained at Quillimane for nearly three weeks by the Portuguese authorities. Another fortnight was occupied in struggling up the stream, to a place from which they had to carry their boats overland to Mazaro. At this latter place they were again detained by a Portuguese official, who charged six times as much for the canoes he supplied as the natives charged for theirs. It took another three weeks to reach the foot of the Murchison Cataracts. To carry the steel boat, which was given by the masters and scholars of Harrow School (where his son was formerly a master), up the Cataracts required another week. No doubt it would be much easier to get down the river from the Lake. He was afraid that the boat was scarcely suitable for such a stormy lake: one of the principal difficulties of transit on the lake being the severe storms which occurred there.

Sir BARTLE FRERE said, to African travellers like Dr. Moffat, Colonel Grant, General Rigby, and Colonel Gordon, the accounts which had been given in the Papers just read, must appear like a pleasing dream. Dr. Moffat would recollect that, when he went out to his mission, there was not a steamer on or near any river in Africa. For some time after that, there were none nearer than Malta, none in the harbour of Alexandria, none upon the Nile; but at the present time there was not only steam communication along the coast, but steamers had actually been placed upon the lakes. It was a by no means improbable dream that ere long Mr. Young might shake hands with Colonel Gordon on the deck of one of their steamers. There was another most important sign of progress. Mr. Price, coming as he did from a noble stock of discoverers, had found a way by which to substitute cattle-power for the human beings who, over so many roads in Africa, were still the only means of communication and of carriage. Some of those gentlemen whose inquiries had led them into the ancient doings of the people who lived upon the lakes of Switzerland before the Romans introduced their civilisation into Europe, must have thought that they were listening to an account of the ancient Helvetians, and of some of the long-headed people who preceded the Picts and Scots on the borders of the Scotch lakes, who used to adopt exactly the same devices to protect themselves, as Mr. Young had found prevailing in Africa. However, it was to be hoped that a ray of light had now been let in upon the savage tribes of Africa, which would very soon be followed by broad daylight.

Sir SAMUEL BAKER said, as he had spent nine years in Africa, he felt extreme interest in the rapid progress that had now set in there. Only a few years ago the map of Africa, instead of being filled up as at present, was endeared to idle school-boys from the fact of its containing nothing for them to learn. The great mystery—the solution of which had been attempted by the greatest of the ancients, even by the Cæsars themselves, and given up as an impossibility—had at last been attacked by England. Headed by Livingstone, who gave the impulse, Englishmen had set themselves to explore the continent; and not one who had started in command of an expedition had failed to gain his object, and be rewarded by the approbation of his countrymen. The great difficulty had always been the want of means of transport, and the route from Zanzibar had been proved to afford facilities which no other part of Africa possessed, as carriers could be obtained there. The expense, however, was so enormous, that few people could afford to engage in explorations on their own resources; and even few societies, except the Royal Geographical, had means for such work. The greatest question now was, how to improve the means of transport. He had been exceedingly gratified to hear that Mr. Price had started the use of bullock-waggons: in fact, it was strange that they had not been used before. The steamer which Colonel Gordon now had on the Albert Nyanza, a vessel of 38 tons, besides two life-boats of 10 tons each, a steamer erected at Gondokoro, of 108 tons, and another of 250 tons, now travelling up from Khartum, were all carried 400 miles across the desert, by the expedition which he (Sir Samuel) had led. The transport was accomplished by a man who unfortunately was now dead, the lamented Edwin Higinbotham. One of the pieces weighed 8 cwt., which could not possibly have been conveyed except by wheels. This was taken on the gun-carriages of 32-pounder howitzers, lashed together and drawn by camels. Forty-two railway-truck loads of machinery were transported to Gondokoro, without the loss of a single screw. This showed the advantage of wheeled carriages, without which it would have been utterly impossible to have moved a great weight, such as a steam boiler, across the desert. It must be gratifying to the Royal Geographical Society to note the success with which African exploration had been carried on since Livingstone first started it, and Speke and Grant opened up the new route to the interior; and to remember that, without the assistance of the Society, the continent would still be the blank which it formerly was.

The Rev. ROGER PRICE said he should like to feel that the sympathy of the Royal Geographical Society had been secured in behalf of the great work which was now being carried on in Central Africa. An African bullock-waggon was a rough concern, a slow coach, but it had done a great work in the south. He had himself seen a huge boiler at a distance of 1400 miles from Cape Town, which had been taken there whole by the bullock-waggon. It was of course a great weight to get on a waggon, but the colonists there had their own ways of getting over difficulties. They made a hole and buried the waggon, and rolled the boiler on to it. Towns of 40,000 or 50,000 inhabitants were now to be found far inland, where six or seven years ago there was nothing but a wild, howling waste, and all the material for building these towns had been taken there through the agency of bullock-waggons. He hoped that similar wonders would be wrought by the same means in Central Africa. In connection with the new route which he had discovered, a steamer of light draught was needed at Zanzibar, as at present the only means of transport from that island to the mainland were Arab dhows. It was to be regretted that at the commencement of the route there was not a better port than Saadáni, but no doubt the skill of engineers could get over that by making a jetty. He would also desire to lay stress upon the necessity for making a road across the coast regions, which was about one-third of the whole distance to Tanganyika, but equalled in difficulties the other two-thirds. The great plateau would offer no special difficulty in the way of the establishment of a waggon-route, and he expected that a sufficient road would be made by the passage of one waggon after another. Something better than that would, however, be required for the coast region and the mountain ranges. It would always be more or less unsafe to traverse that region, in consequence of the amount of water and the risk of fever; and it was therefore desirable to adopt means for making the journey across it as speedy as possible. It was important to have at least two stations. One he would recommend to be established on the western border of the valley of Nguru, about the southern end of the Nguru mountain range; and another at Mpwapwa, which was a most important, though by no means an interesting place. It was there that the various routes from the coast met, and from thence a fresh start was made for the long journey across the plateau to the Lake. It could be made an important depôt during the dry season, for he took for granted that for some time to come it would be impracticable to traverse the coast region during the height of the rainy season. The dry season, however, was sufficiently long for the stuff required for commerce to be brought to Mpwapwa and deposited there, to be conveyed to the far interior whenever necessary. In these undertakings the Royal Geographical Society could give valuable assistance. If the Cape bullock-waggon was successfully introduced into the interior, the time would not be far distant when a steamer of very considerable pretensions would ply upon the broad and beautiful waters of Tanganyika.

The PRESIDENT, in concluding the meeting, said the papers and the discussion might be almost summed up in two words, bullock-waggon and steamer. These applied, the one to the land, the other to the lakes, would effectually open up Central Africa, and work all the marvels of an Aladdin's lamp. Nothing could be more encouraging than the progress the work of Exploration had made, under the auspices of the Royal Geographical Society, since Livingstone gave it the first impulse. The Society could desire no greater honour or brighter wreath than that which it had gained by contributing to the opening up of Africa to civilization and commerce.

Votes of thanks were accorded to the authors of the Papers, and the meeting then adjourned.

* * *

Special General Meeting, March 5th, 1877, 3 P.M.

SIR RUTHERFORD ALCOCK, K.C.B., PRESIDENT, in the Chair.

The purpose for which the Meeting was convened is explained in the following Circular, which was posted, within the limits of time required by the Regulations, to all Fellows whose addresses in the United Kingdom were known :—

1, SAVILE ROW, S.W.,
February 23rd, 1877.

A SPECIAL GENERAL MEETING of the Fellows is convened for Monday, March 5th, at 3 P.M., at the Hall of the University of London, to consider the following Resolutions, of which notice has been given by Sir Mordaunt Wells:—

"That a Committee of six Fellows of not less than ten years' standing be appointed to investigate the circumstances relating to the issue of Visitors' tickets, to whom, and by whom, such tickets were granted on the occasion of the Meeting of the Royal Geographical Society, at St. James's Hall, on Tuesday, the 12th day of December, and the authority for the same.

"That the officers of the Society be requested by the Council to furnish the Committee with such information as the Committee may deem necessary and advisable.

"That the following Fellows be appointed to act as Members of the Committee:—

Sir ALEXANDER ARMSTRONG, K.C.B. and F.R.S.,
Colonel H. F. AINSLIE,
Professor M. C. VINCENT,
Sir MORDAUNT WELLS,

together with two Fellows of the same standing, to be nominated by the Council.

"That the President be invited to preside over the proceedings of the Committee.

"That three members of the above Committee shall constitute a quorum, and that the Committee be empowered to report the result of their proceedings at the Meeting of the Society to be held on the 12th of March, 1877.

"That the Meetings of the Committee be held at the office of the Royal Geographical Society, 1, Savile Row."

Sir Mordaunt Wells notified his intention of moving the above Resolutions at the Evening Meeting of February 26th; but as nothing relating to the Regulations or Management of the Society can, according to the Rules, be brought forward at the Ordinary Meetings ('Charter and Regulations,' chap. v. sec. 3, para. 5), the Council, in accordance with these Rules, have called a Special Meeting for the purpose.

A full attendance of Fellows is requested.

C. R. MARKHAM,
R. H. MAJOR,
Secretaries.

⁂ As none but Fellows can be admitted, it will be necessary that each should be ready to produce his "Fellow's Ticket" for 1876-7, on entry.

By direction of the Council, the following Explanation, relating to the Rules and practice concerning Admission to the Evening

Meetings, was also sent to the Fellows before the day of the Special General Meeting:—

1, SAVILE ROW, S.W.,
March 1st, 1877.

IN prospect of the Special Meeting to be held on March 5th, the President and Council of the Royal Geographical Society have thought it desirable to lay before the Fellows a statement of the Rules and practice hitherto adopted, for the accommodation of Fellows and Visitors, at Evening Meetings of the Society.

Until the Annual General Meeting held on May 24th, 1875, each Fellow was entitled, under a Standing Rule of the Society, to introduce one gentleman or two ladies, as Visitors, at any Evening Meeting. As the number of Fellows now exceeds 3000, if this privilege had continued in force, and been fully exercised by every Fellow, the attendance on an occasion of exceptional interest might *possibly* have amounted to above 9000—a larger audience than could be seated within any Hall in London. To guard against an overwhelming influx of Visitors, and to give Fellows a reasonable precedence in the distribution of seats, certain restrictions on the right of introduction have from time to time been sanctioned by the Society. For instance, by another Rule, not yet abrogated, it was provided that no Visitor should be admitted before the Chair was taken, unless personally introduced by a Fellow or by a Council card, but it was found practically impossible to enforce this Rule in face of the determined opposition offered by influential Fellows, and the attempt to do so was abandoned after the experience of one Session. The plan of railing off several front benches for Fellows not accompanied by Visitors was frustrated by similar difficulties, and though it is still the custom to label two front benches "For Fellows only," even this limited reservation is not always respected. In the mean time, since Visitors' tickets were not required to be dated, it constantly happened that many Fellows signed more than two for the same evening, especially when the Meeting was unusually attractive, thereby appropriating more than their fair share of the available space.

It was to remedy inconveniences and irregularities of this kind that, at the General Meeting of May 24th, 1876, the Rule first cited was amended by the addition of a clause "empowering the Council to restrict the privilege of admission to one friend for each Member, whenever such restriction seems to them absolutely necessary." Acting upon this authority, and in accordance with the recommendation of a Special Committee, the Council has introduced the present system of dated Visitors' tickets, one of which may be filled up by each Fellow for each Evening Meeting. This Regulation is still in force, and governs the admission of Fellows and Visitors at all the Evening Meetings of the Society. At Ordinary Meetings the system thus established is found to work very well. One bench, nearest the platform, is set apart for Members of the Council and their friends, in accordance with the practice of this and other learned Societies. Two other benches are allotted to Fellows not accompanied by Visitors, and the rest of the Hall is left free to Fellows and to Visitors presenting dated tickets. Of course, disappointment is sometimes expressed by Fellows coming in late and failing to obtain an eligible place, but few, if any, definite complaints of the arrangements made for Ordinary Meetings have reached the Council.

On the other hand, the arrangements made for Meetings of exceptional interest, whether at Burlington Gardens or St. James's Hall, have often been the subject of criticism, and the pending Motion of Sir Mordaunt Wells expressly refers to one of such Meetings, held at St. James's Hall on December 12th, 1876. The complaint which it embodies is understood to rest on two distinct grounds: (1), that an inordinate number of ladies and other Visitors occupied the body of the Hall to the exclusion of Fellows, many of whom, arriving at the hour appointed for the opening of the doors, found the best places already taken; (2), that an inordinate number of seats were reserved by the President and Council for their own friends.

1. Upon the first point it may be observed that, unless and until the amended Rule is repealed or suspended by a Resolution of the Society, the President and Council have no power to control the right of each Fellow to issue one Visitor's ticket for each meeting. No such measure has yet been proposed, nor have the President and Council any reason to believe that it would be acceptable to a majority of Fellows, while it would assuredly prejudice the popularity of the Society. The extent to which Fellows avail themselves of this right on special occasions, is perhaps the best proof of the value attached to it. During the few days which preceded the Arctic Meeting of December 12th, no less than 1600 Fellows applied for and obtained their Visitors' tickets, and many subsequently applied for extra tickets. As St. James's Hall is only constructed to accommodate 2000 persons, it is manifest that if all these Visitors had gained admission, but a small fraction of the Fellows could have been seated at all. As a matter of fact, the first comers were of necessity first accommodated, no distinction being made in favour, either of persons holding Visitors' tickets, or of Fellows coming without Visitors. It is true that, owing to causes which the President and the Council regret, but over which they had no control, many Fellows and Visitors succeeded in possessing themselves of good places before the appointed time. The explanation of this circumstance is that, finding the approaches so thronged as to obstruct the traffic seriously, the police ordered the doors to be opened, and those who happened to be on the spot reaped an advantage which may well have appeared unfair. But the Council are not aware that anyone obtained an entrance except Fellows, or Visitors holding tickets, and the proportion of those excluded to those admitted would have been exactly the same had no such miscarriage occurred.

2. In the distribution of reserved seats, as well as in the general arrangement of the Meeting, the President was assisted by a Special Committee of the Council, the members of which also consented to act as Stewards. The whole number of seats reserved amounted to 406, of which 200 were on the platform, 58 in the balcony, and 148 on the floor of the Hall. No complete list exists of the individuals to whom these seats were assigned, but it is not difficult to specify the various classes recognised by the Committee as having a special claim to such precedence. Besides the President, the Members of the Council, the Officers of the Society, and the Officers of the Arctic Expedition, reserved seats were provided for H.R.H. the Prince of Wales and his suite, the Foreign Ambassadors and Ministers, the Lord Mayor and Lady Mayoress, the Lords of the Admiralty and their Secretaries, the heads of several Public Departments, the Presidents of various learned Societies in correspondence with the Royal Geographical Society, some ex-Members of the Council of the Royal Geographical Society, the Officers of previous Arctic Expeditions, the Officers of the *Pandora*, the editors of leading newspapers, and a few other persons of distinction, the residue being occupied by the relations and friends of Arctic Officers, and Visitors introduced by the President himself or by Members of the Council, to each of whom two reserved tickets were allotted. Thus, excepting the President and Council and Officers of the Society, with a small number of Visitors invited by them, all the reserved seats were filled by public guests of the Society, selected by the Special Committee, under the authority of the President and Council, and including a body of Arctic Officers, numbering, with their friends, little less than 100.

Having made this statement, the President and Council do not think it necessary to justify the manner in which they have exercised the discretion entrusted to them by the Society, feeling assured that, if it should be impugned, they will be supported by the general voice of the Fellows. They do not believe that any fresh Regulations will avail altogether to overcome those inherent difficulties which arise from the size and constitution of the Society, or to relieve them of the responsibility which must ever devolve upon the governing body, in the interest of all the Fellows. They are, however, fully prepared to review the operation of the existing Rules by the light of recent experience, and to consider any improvements that may be suggested. With this view, they have recorded in a Minute—an extract from which is hereto appended—their readiness to concur in the appointment of a joint Committee, nominated in equal proportions by themselves and by the Fellows, but they would now further propose to omit the qualification of ten years' standing for the Members so nominated. The alternative proposed in the Resolution of Sir Mordaunt Wells is one which it is impossible for them to accept, since it implies, if not censure, yet a want of that confidence without which it would be difficult, if not impossible, to conduct the affairs of any Society in a satisfactory manner.

By order of the Council.

C. R. MARKHAM,
R. H. MAJOR,
Secretaries.

EXTRACT from a MINUTE of the COUNCIL of the 12th February, read at the Evening Meeting of that date, with Sir MORDAUNT WELLS' *notice of Resolutions.*

The only question is, whether any alteration can be made in the Rules of the Society or in the practice hitherto observed on great occasions, which may, without injury to the best interests of the Society, tend to remove any complaints on behalf of the Members. Such a question the Council are the first to acknowledge is a proper subject for investigation by a Committee.

The Council, then, propose that a Committee should be appointed, consisting of an equal number of members of the Council and of Fellows of over ten years' standing, to be selected from the general body, the President of the Society being the Chairman *ex-officio.* The duty of the Committee will be to inquire into the working of the existent Rules and practice and to report thereon, with liberty to recommend for the approval of a General Meeting any new Rules or modifications in practice with a view to remove as far as possible all causes of complaint or dissatisfaction.

The proceedings of the Meeting began by Sir MORDAUNT WELLS proposing his Resolutions in accordance with the notice given.

The Motion was seconded by the Rev. J. WHICHELOW.

The Hon. G. C. BRODRICK offered some explanations on behalf of the Council, of similar nature to those contained in the Circular given above.

Lord ABERDARE then proposed the following Amendment to the Resolutions of Sir MORDAUNT WELLS:—

That a Committee be appointed, consisting of five members of the Council and five Fellows to be selected from the general body, the President of the Society being the Chairman *ex-officio*; and that the duty of the Committee be to inquire into the working of the existent Rules and practice, and to report thereon, with liberty to recommend for the approval of a General Meeting any new Rules or modifications in practice, with a view to remove, as far as possible, all causes of complaints or dissatisfaction.

Mr. F. CALVERT, Q.C., seconded the Amendment.

Sir MORDAUNT WELLS replied on the Amendment.

The PRESIDENT put the Amendment to the Meeting; but before the show of hands "to the contrary" was taken, Sir MORDAUNT WELLS said he was prepared to accept the Amendment, provided Lord ABERDARE would consent to tack it on to the original Resolutions.

On Lord ABERDARE declining to do this, as tending to complicate the matter, the Amendment was definitely put, and carried by a large majority.

A division was then demanded, on the ground that the Meeting did not quite understand the issue before them. But, at the suggestion of the Right Hon. A. S. AYRTON, the Amendment was again put as a Substantive Resolution.

On a show of hands being again taken, the Amendment in this form was again carried by a large majority.

On the motion of Lord ABERDARE, seconded by Sir MORDAUNT WELLS, the following gentlemen were selected to act as Members of the Joint Committee on behalf of the general body:—

Sir MORDAUNT WELLS,
Sir ALEXANDER ARMSTRONG, K.C.B., LL.D., F.R.S.,
General Sir GEORGE BALFOUR, K.C.B., M.P.,
Dr. ALFRED BARTON.
F. CALVERT, Esq., Q.C.

The proceedings then terminated.

Eighth Meeting, 12th March, 1877.

SIR RUTHERFORD ALCOCK, K.C.B., PRESIDENT, in the Chair.

PRESENTATION.—*Godfrey Darbishire, Esq.*

ELECTIONS.—*James Coate, Esq.; Charles E. Cooper, Esq.; Edward Prichard Evans, Esq.; Joseph Faulkner, Esq.; Rev. William Theophilus Giles*, M.A.; *Robert Logan Jack, Esq.; James Kennard, Esq.; Colonel Henry Man* (Madras Staff Corps); *John Thomas Howie-McEwan, Esq.; Arthur A. Pearson, Esq.; John Alexander Sandilands, Esq.*

DONATIONS TO THE LIBRARY, 26TH FEBRUARY TO 12TH MARCH, 1877.—Archæological Survey of Western India; Report on the Antiquities of Kâthiâwâd and Kachh, by J. Burgess, 1876 (*H.M. Secretary of State for India*). The Changes of Exmouth Warren, by J. M. Martin, Pt. 2, 1876 (*Author*). Perseverance in Arctic Exploration, by J. O. Chadwick, 1877 (*Author*). The Gem Geography, by J. A. Butterworth, Pt. 1 (*Author*). Charts of Meteorological Data for nine 10-degree Squares of the Atlantic, with accompanying Remarks, 1876 (*The Meteorological Committee*). Catalogue of the Royal Engineer Corps Libraries, 1876 (*The R. E. Corps, per Lieut. F. J. Edwards*). Histoire de l'Asie Centrale, 1153–1818, par Mir Abdoul Kerim Boukhary, Persian text and French translation by Charles Schefer, Paris, 1876, and Persian text of the Relation de l'Ambassade au Kharezm, par Riza Qouly Khan, publications de l'École des langues Orientales vivantes (*The Minister of Public Instruction in France, through H.B.M. Ambassador in Paris, favoured by Lord Tenterden*). Report of the Kew Committee for year ending October, 1876 (*The Committee*). Zur Frage der Meerescirculation, von H. Schmick (*Author*). General Report of the operations of the Marine Survey of India, 1874–76, by Commander A. Dundas Taylor, Calcutta, 1876, and List of Light-houses, &c., in British India, to 1st January, 1877, by R. C. Carrington, Calcutta, 1877 (*Commander Taylor*). Géographie de la Soie, par L. Clugnet, Lyon, 1877 (*The Lyons Geographical Society, per M. A. Brun*). The trade of Central Africa, present and future, by V. L. Cameron, 1877 (*Professor Tennant*).

DONATIONS TO MAP-ROOM, FEBRUARY 26TH TO MARCH 12TH, 1877.—Map of Western Australia, showing Explorations made between the years 1872 and 1876; Surveyor-General's Office, Perth, W.A. (*John Forrest, Esq.*). Four sheets of the Topographical Atlas of Denmark, $\frac{1}{40000}$ (*Royal Danish Ministry of War, through Count von Bulow*). MS. map showing Country round Port Moresby, New

Guinea, by Octavius C. Stone (*Author*). MS. map of River Beni, Bolivia, showing proposed routes of exploration, by Juan B. Minchin (*Author*). MS. Sketch-map of Country about the Source of the Joliba, West Africa, by Benjamin Anderson (*Author*). Map of Perak and Sangalore, Wellesley Province and Pulo Penang, by Major McNair, R.A.; Sketch-map of Country round Malacca; Sketch of the Perak River; Survey of River Linghy and of Tracks from Linghy to Rassa, and from Lukut to Rassa, Sunghy Ujong (*W. Barrington d'Almeida, Esq.*).

The President announced that two Papers were to be read; the first by Mr. Buchanan, who had served as chemist on the scientific staff of the *Challenger* Expedition. It related to the distribution of salinity in the ocean, or its saltness at different depths and in different latitudes; and dealt with several interesting problems in Physical Geography, as to the dissolving power of the water, its specific gravity, its effects upon the deposits. The second Paper was by Mr. Allen, of Her Majesty's Consular Service, on an interesting journey he had made into the interior of Formosa, a part of that island, occupied by aborigines and savage tribes. A third Paper on the same island was by Mr. Bullock; extracts from which would be read, if time permitted.

The following Papers were then read:—

1. *On the Distribution of Salt in the Ocean as indicated by the Specific Gravity of its Waters.* By J. Y. BUCHANAN, Chemist in the *Challenger* Expedition.

[ABSTRACT.]

THE specific gravity of the water from the surface was determined every day during the cruise when at sea, and from the bottom and intermediate depths as often as opportunity offered. The instrument used was a glass hydrometer, combining the advantages of Nicholson's hydrometer with those of the one with divided scale. The results obtained with it were accurate to 5 in the fifth decimal place. The observations were always made when the water was sensibly at the temperature of the atmosphere, the results so obtained were reduced, by means of the tables of the late Professor Hubbard of Washington, to their value at the standard temperature of 15·56° C. (60° F.), the density of distilled water at its temperature of maximum density being unity. In this way the specific gravity of nearly 2000 different waters was determined. These were all *ocean* waters—that is, they were from localities free from the local effects caused by proximity of land—and the specific gravity of such waters has been found to vary between 1·024 and 1·028, between which limits we may assume with certainty that the salinity varies with the specific gravity.

The distribution at the surface of saltness thus indicated was exhibited on a chart by means of differently coloured areas, and the vertical distribution was shown in the diagrams representing meridional sections of the Atlantic and Pacific Oceans respectively.

As far as the surface is concerned, the general results were as follows. The concentration of the waters of the Atlantic is greater than that of either the Pacific or the Southern Ocean, and it is greater in the North Atlantic than in the South Atlantic, although the actual maximum may be slightly higher in the South Atlantic. In the North Atlantic the maximum was observed in 22° N. latitude and 40° W. longitude, from which point it diminishes in all directions. The maximum in the South Atlantic was 1·02785 off the coast of Brazil, in latitude 17° S. In the Pacific the areas of concentration are much less pronounced, the maximum of 1·0272 occurring near the island of Tahiti. In the North Pacific the maximum is under 1·0265, and situated about 22° N. Between the north and south maxima in these oceans is situated the area of equatorial dilution. Following the equator from east to west in the Atlantic, the water increases markedly in saltness: in the Pacific the same is the case, though in a less degree. On the polar sides of the areas of concentration the saltness diminishes as the latitude increases, at first rapidly, then more slowly. The whole of the Southern Ocean between the parallel of 40° S. and the edge of the ice appears to have a very uniform surface specific gravity of about 1·0250. In the North Pacific, to judge from Lenz's observations, it is lower, and in the North Atlantic higher.

If we consider the water below the surface, as shown in the vertical sections, we find, in the Atlantic, that in the concentration-areas the specific gravity diminishes until a minimum is reached at a depth of about 800 or 1000 fathoms, after which it increases slightly down to the bottom where, in the South Atlantic and in the Pacific, a tolerably uniform specific gravity of 1·0257 to 1·0259 is observed. In the areas of equatorial dilution the specific gravity first increases to a maximum at a depth of 50 to 100 fathoms, after which it follows the same law as the water north and south of it. In the North Atlantic the bottom specific gravity is comparatively high. In investigating the causes of the variations in specific gravity in the ocean, we find that they depend on the means available for removing or supplying *water*. Thus the areas of greatest concentration coincide with those where the dry trade-winds are constantly blowing, taking their rise in the lower temperate latitudes, and proceeding in their course always from colder to warmer regions, so that, for the first part of their journey, at least, although they are continually taking up moisture, their capacity for doing so is continually increasing. Hence the great concentration of the water in the steady Trades of the Atlantic. On the other hand, the westerly winds of the higher temperate latitudes which take their rise at the same source, proceeding in the first part of their course from warmer to colder latitudes, are soon comparatively saturated, and incapable of concentrating the waters over which they blow. The moisture taken up by the trades is wrung out in the equatorial calms, where it descends as heavy rains, and dilutes the sea water. Comparing the salinity of the sea surface with the distribution of barometric pressure, we find that the maximum of saltness lies in the northern hemisphere to the south-west, and in the southern hemisphere to the north-west, of the barometric maxima. Concentration is also brought about by the formation of ice, and in regions where more ice is formed in winter than melts in summer, which in the southern hemisphere would enclose a very large area, the effects must be cumulative. In the Southern Ocean the specific gravity of the bottom-water was always much higher than that of the surface.

The high-bottom specific gravity in the North Atlantic depends not only on the lake-like form of the basin in which the water is kept by tangential winds and currents from getting out of the concentrating effects of the trade-winds, which effect is propagated downwards to a great extent by the difference between the summer and winter temperatures, but also on the fact that all the accumulations of salt brine from the Mediterranean are emptied into it through the Straits of Gibraltar. It is probable that a similar effect is produced on the Indian Ocean by the proximity of the Red Sea.

The observations make it probable that in the Atlantic the water from the surface, down to a depth of 1000 fathoms, has on the whole a flow *inwards*, or from south to north, and below that depth and down to the bottom it appears to have an opposite flow, thus providing for the removal of the salt which otherwise would accumulate in the North Atlantic. The Atlantic thus presents on a larger scale what is observed in the Mediterranean, where the mean drying power of the atmosphere is higher than even in the North Atlantic. In the Pacific, owing to its form and general climate, these conditions are not so evident.

[The above Paper will be printed *in extenso* in the 'Journal,' Vol. xlvii.]

Mr. FRANCIS GALTON asked Mr. Buchanan whether, as a rule, in passing from one ocean-current to another, his instruments gave any indication of the change. It was obvious that two adjacent currents must usually have different amounts of salt in their composition, and he would like to know if, with the very delicate instruments used by the *Challenger* Expedition, and the great precautions which were taken in making the observations, such differences became sensible.

Mr. BUCHANAN replied that there was no doubt that in the currents of the ocean there was very considerable difference in the specific gravity of the water, as well as in the temperature. In the chart suspended before the Meeting the Gulf Stream was very clearly indicated simply by the specific gravity, or rather the edge of it, where the warm and dense water of the Gulf Stream met what was called the "cold wall" of the Labrador current. The Equatorial currents also were very marked, being fresh. The Agulhas current of South Africa showed similar variations in density.

The PRESIDENT said the Society was much indebted to Mr. Buchanan for his interesting Paper on a subject involving various scientific problems. It was calculated to throw considerable light upon many of those questions, but he was afraid the Meeting was scarcely competent to discuss them at any length. Such Papers, however, must tend very much to improve their knowledge of Physical Geography, precisely on those points on which it was most difficult to collect authentic facts. Such facts could only be obtained by an expensive and elaborate expedition, such as Her Majesty's Government fitted out in the *Challenger*. Mr. Buchanan was one of the body of scientific men who were sent on the three-and-a-half years' voyage, and the Paper which had just been read contained merely a fragment of the valuable results which had been obtained. When the whole of those results were made public, it would no doubt be shown that the Government of a civilised and cultivated country like England could not possibly devote some portion of its funds, and the energies of its scientific men, to a better object.

2.—*Notes of a Journey through Formosa from Tamsui to Taiwanfu.*

By HERBERT J. ALLEN, H.M. Consular Service, China.

LITTLE is known of the interior of Formosa, and a short sketch of a journey from the Treaty port of Tamsui to that of Taiwanfu, in which the heart of the island was visited, will perhaps be of some interest. Formosa, situated about 100 miles from the mainland of China, is about 240 miles by 80 broad. The Chinese name of it, Taiwan, or Bay of the Raised Terrace, probably refers to the square flat-roofed blockhouse, Fort Zelandia, built by the Dutch when they were in possession of the island, and which is now a mark for vessels making the anchorage at the capital, Taiwanfu. The department is, according to Government statistical works, divided into the subdistricts of Komalan, Tamsui, Changhua, Kia-i, Taiwan, Fengshan, and Pênghu, or the Pescadores, of which Komalan is the only one on the eastern side of the island. The Chinese Government charts do not depict the coast-line on that side at all, the boundary being represented by a mass of mountains. The central ranges, the southern and eastern coasts, are principally inhabited by various tribes of aborigines, totally unlike in dress and features to the Chinese, who call them barbarians, and treat them accordingly. Some of the districts have been so enlarged lately by the constant encroachments of the Chinese on savage territory that last year it was deemed necessary to increase the number of governing officials; Komalan and Tamsui districts were abolished, and a department of North Formosa, with three dependent magistracies, established in their room. The Chinese Government forbade their people to cross the boundary of savage territory, at one time well defined; but since the Japanese expedition against the Bootan tribe of aborigines in the south in 1874, they altered their policy, and, finding themselves looked on as masters of the whole island, took active steps to improve their knowledge of it. Schemes for cutting roads through the hills were set on foot, colonists were bribed to settle in out-of-the-way places, and presents given liberally to the aboriginal chiefs, who were urged to acknowledge Chinese rule. These measures have not been altogether successful, in consequence of the persistent antipathy and mistrust shown by the savages, and the petty war goes on whenever the Chinese try to penetrate into the hills unaccompanied by a large force.

Being invited by Mr. Mackay, of the Canadian Presbyterian Mission in the north, and Mr. Ritchie, of the English Presbyterians in South Formosa, to accompany them on a tour they intended to take to visit their respective stations, I started on the 10th of November, 1875, from the old Dutch fort, then used as a Consular residence, at Tamsui. I crossed the harbour near its entrance, and skirting the western side of the Kuanyin Hill, 1720 feet above the sea, gained the table-land, which stretches some 30 miles down the coast. I halted at the little village of Doaheng for dinner, and went on 10 miles further by moonlight to the inn at Tionglek, where my companions were sleeping, they having earlier in the day left their chapel near Banka, the largest and most commercially active town in North Formosa, 8 miles up the Tamsui River, and gone by another road. The next morning we made an early start, and the air on the plateau being very invigorating, walked 8 miles before breakfast, passing many villages of Hakka Chinese immigrants from Kuangtung Province. The plain was cultivated with paddy and sugar-cane crops, and we constantly met heavy four-wheeled carts with axles, doubtless introduced by the Dutch, which were generally drawn by a buffalo, with two of the ordinary black cattle of the country on each side, yoked abreast. About 8 miles from Tekcham we reached Table Hill, or Windhill Slope, as its Chinese name signifies, which was the termination of the plateau. From this point we got a good view of the sea westward, the valley with its pretty river winding along at our feet, and clumps of bamboos on the opposite bank, which screened the town from sight. Descending the hill, we crossed the river in one of the flat-bottomed boats used here. The ferryman held on to a rattan-rope, securely fastened to stakes at each bank, as he swung his boat across the stream, which in the rainy season becomes a rapid torrent.

Tekcham, being the capital of the Tamsui district and containing the yamên of the sub-prefect, has acquired a sort of fictitious importance which its trade does not warrant. At the time of my journey the sub-prefect was absent in another part of his district, which stretched along the north and west coasts for a distance of, say, 100 miles, with a breadth of from 10 to 30 miles, and covering an area of 1250 square miles.

On our third day's march we soon came to the sands, which stretch some way out to sea, and make this part of the coast very dangerous for anything but flat-bottomed Chinese junks, and there had, in fact, been two wrecks of English vessels lately, as the timber lying about the shore testified. A proclamation posted at a road-side inn by one Lo, assistant commandant of the North Formosa troops, warned the people that they would be punished if they carried off the wrecked wood, on the ground that the ocean-men (foreigners) might make capital of the fact, and create disturbances. The authorities have certainly been more energetic than they were in old days in putting a stop to the evil of wrecking, although they work on the fears of the common people rather at the expense of our reputation. We passed through the large towns of Heongsan and Tiongkong, crossed a sandy shallow inlet of the sea half a mile wide, which afforded a good anchorage for junks, and leaving the large town of Oulan on our right, soon came in sight of Sinkang, our destination for the day. We were warmly welcomed by the catechist of the chapel here, who came running to meet us, and lodged us in the Mission-rooms. We had had a tedious march of 20 miles, most of the way over a desert, and had been not a little annoyed by the sand blown into our faces by the high wind. Sinkang is the last of Mr. Mackay's stations, and as it is but one day's journey from Laisia, the most northerly of the South Formosan Mission-stations, there is a complete chain of chapels from Kelung in the north to Takow in the south. Most of the converts in Sinkang are Pepohuans, or semi-civilised savages of the plains, who are found generally established in small colonies between their Chinese conquerors and their brothers, the wild aborigines of the interior. They practically adopt the Chinese dress and tonsure, but their features distinctly show that they were originally of the aboriginal or Malayo-Polynesian stock. A simple-minded and quiet people, they are looked down on by the Chinese as huans, *i. e.* barbarians, and they do not scruple to possess themselves of their lands, under pretence of renting them, the complaints for redress to the officials being too often unattended to. On the side of the hills they are frequently cut off by the wild savages, who look upon the acquisition of human heads with pigtails as proofs of valour, without a certain number of which a young chief cannot get a wife. The Pepohuans are sometimes called Sekhuan, which means civilised barbarians, to distinguish them from the Chihuan, or wild barbarians, and are governed by tongsu, or headmen. The one over this tribe paid a squeeze of 300 dollars a year for his post, part to the sub-prefect of Tamsui and part to the sub-prefect of Lokong, in the Changhua district, under the jurisdiction of which latter official he more immediately is. After leaving Sinkang we passed a string of Hakka Chinese villages, the largest of which was Bali. Rice and sugar are grown in this valley, and people seemed well-to-do. We halted at midday at Tunglowan. Crossing the rocky bed of what would evidently be a torrent in the rains, we travelled up a long and very pretty valley, then over a small range of hills, and towards evening came down a very steep hill to Laisia. This Pepohuan colony, which is entirely Christian, the population of which numbers 200, including women and children, is an offshoot of the huans of Posia. They said thirty or forty of them came here twenty years ago, and that they were of the Padjieh tribe, the tribe at Sinkang being called Balua. The colony consisted of two small enclosures, about 100 yards square each, well fenced in with bamboos, and further protected from attacks of savages by sharp-pointed stakes, which stuck up a few inches out of the ground close to the outside of the fence.

On the sixth day we resumed our march, and passing through the small Chinese village of Sintiam, which has sprung into existence within the last two years, struck along the base of the hills over a plain some miles wide, strewed with rocks and boulders, without any discernible path through it, and reached Toasia early in the afternoon.

As we were now going to have rougher travelling than we had had, we despatched a courier to Taiwanfu with our surplus baggage, and letters to inform the Consul of our plans. We went S.S.E. for 13 miles over a fertile plain, cultivated with sugar-cane, tobacco, ground-nut, sweet potatoes, &c., drawing gradually towards the range of hills on our left. At the head of the gorge, due east of the district town of Changhua, we were met by a party of thirty or forty tall, stalwart Pepohuans, armed with knives and matchlocks, who were to be our bodyguard through the mountains, to protect us from the savages. The gorge wound a good deal, but our general direction was east; the jungle on both sides was very thick, and the Pepohuans now and then set it on fire. After we had gone about six miles over rocks and stones, through pools of water, the pass narrowing as we went, we reached a point where a big camphor-tree blocked it up almost entirely, and we had great difficulty in getting the chair through. The pass was here only 5 feet wide, and I could touch the perpendicular walls of rock on each side. The scenery was magnificent; the mountains, rising 2000 or 3000 feet almost perpendicularly on each side, were covered with camphor and other forest-trees. At one time a felled tree across our path made an arch for us to pass under, and again we were obliged to scramble along the trunk of another big denizen of the forest. I noticed one or two veins of coal on the rocks; and a stratum of conglomerate pebbles in the clay, 600 feet above us, was also remarkable. We encamped for the night in the middle of the gorge; lit a fire, and boiled some of our tinned soups in true gipsy style. Blankets spread on bundles of leaves formed our beds, and in spite of a heavy dew we got a good night's rest. We started before daybreak on the morning of the eighth day of our march, and after five more miles of rough scrambling, at which our savage friends were quite *au fait*, got to the end of the gorge. The ranges of hills now opened out, and, although we occasionally had to cut our way with long knives through the jungle, travelling was much easier work. We found a small, edible, acid fruit, like a raspberry, growing here; as well as a sweet-smelling fern, which the natives called Tanpa. We did not meet any wild savages; but were pointed out a spot where, five years previously, the Pepohuans had a fight and killed thirteen of them. We crossed one pretty broad and rapid stream, in fording which the Pepohuans were immersed up to their necks, and six or seven smaller ones; and just after dusk reached the beautiful valley of Posia, or Polisia as it is also called. Torches had been sent to meet us by some of the party, who had pushed on quicker than the others; and the Chinese chair-coolies, being dead-beat, had to give place to the stalwart Pepohuans, who, with shouts of laughter at the unaccustomed task, picked up the chair and came along over the level ground at a rapid trot which nearly shook me out of it. We slept that night in comfortable beds at the Mission-station of Ougulan, one of the 33 villages in this plain. Posia is a fertile, almost circular, well-watered plain, about 8 miles in diameter, and surrounded by wooded hills in which the wild savages roam in their hunting-excursions. The population, numbering about 5000, include a few Chinese who come to trade with the Pepohuans in rattans, deers' horns, skins, &c., for which they exchange knives, matchlocks, and gunpowder. The Pepohuans are fair shots. We were out in the woods one day for a few hours, and they succeeded in bagging three moose-deer, the flesh of which was excellent. The missionaries have been very successful here. Their first chapel at Gukunswa, so called from a hillock said to resemble an ox reclining, on the other side of the plain, was built in 1871; the one at Ougulan was next put up; and a third one, with an upper storey, substantially built of brick, was built at the village of Toalam in 1874. I was shown a silver cup, about two inches long, which an old man assured me had been an heirloom in his family for 200 years. From some marks on it, I believe it is really an old Dutch matchbox. They said they remembered the foreigners being in the island. We remained five days at Posia, and were continually being feasted by the converts, a troop of whom escorted us to the bank of a river at the edge of the plain, when we took our departure. Of course we had a small bodyguard to escort us through another pass to the south, not so difficult as the one by which we had entered the plain, and as far as Ousia, a small village of perhaps 1000 Chinese inhabitants of Changchow. They then saluted us by firing their matchlocks in the air and shouting "Pahuria raki" (Peace be with you), returned to Posia. We passed some plantations of tea and before dusk reached the shores of a beautiful lake, 4 miles long by 2 broad, which went by the name of Tsui-sia-hai, or Lake of the Water Savages, a distinct tribe who live on its banks. They are a degraded race, and are employed as slaves by the Chinese, who make them carry heavy burdens, and give them samshoo, of which they are unfortunately only too fond. We found some of them lying intoxicated in their long low huts made of the bark of trees, and resembling their canoes inverted. The whole family live in the hut, which has partitions which only partially screen the women's quarters from those of the men. They tattoo their faces in broad bands across the nose, are tall, and would be well-proportioned, if it were not for a pernicious habit they indulge in of tying cloths tightly round their waists, which deform them very much; but which they said they did to keep them from feeling the pangs of hunger. They fish in the lake, paddling about in long canoes hollowed out of the trunks of trees, which reminded us of the dragon-boats common at Foochow and other parts of South China. I bathed in the lake, and found it very muddy and full of weeds. On a woody islet in the lake, we found a Chinese coffin-maker, who seemed comfortable enough with his bit of kitchen-garden and orchard adjoining his house. A Chinese scholar who lived near the lake took us in, and gave us quarters for the night. The next day, the fifteenth of our march, we travelled in a south-westerly direction over the hills, descending eventually a steep hill, from the top of which we had a fine view of a long valley, with a river flowing from east to west. We reached that evening the large town of Chipchip, which is entirely Chinese, and is the headquarters of a military Mandarin, named Lo, who, we heard, was in command of 500 troops, two days' journey up the valley, employed in cutting a road to Siukuluan, a port on the east coast of the island, in lat. 23° 30′. We had tried to get a Chinese guard to bring us through the hills in the morning; but as there was some difficulty about it, and we were a large enough party to awe the savages, we gave it up. We left Chipchip early the next morning, but were detained some time on the bank of a river. The ferryman had gone away, and some of the helpers swam across to get the boat. They were, however, unskilled in the management of it, the force of the current washed it down against a fish-weir, and it was wrecked. This little *contretemps* obliged us to cross lower down on a raft. We passed a good many villages, one of them, Limkepo, said to contain 3000 inhabitants, had jurisdiction over 24 others in the vicinity. The valley we were travelling through wound about a good deal, and although we did not make much way in a direct line, it was getting dusk before we reached Toulak, our resting-place for the night. An underling from the district magistrate's yamên at Kagee met us here, and said he had been ordered to escort us to Kagee. He helped me in engaging another chair, my former bearers not wishing to go on to the capital, and was very attentive. We struck the main road at Tapona, where we had a good cup of tea at the house of a Mr. Huang; passed a few villages, at the largest of which, Tamao, my companions preached for a short time while we were resting; and reached the Mission-chapel at Kagee on the evening of the seventeenth day. I sent my card to the Magistrate to thank him for his kindness, but he was not at home. I was now within two days' journey of Taiwanfu, and so I bid adieu to my companions, who were going to visit some more stations in the hills to the eastward, and journeyed on *solus* to Ungkangbay. I slept at a comfortable inn kept by a Government underling; and early on the nineteenth day, after a journey of 220 miles, reached Taiwanfu, the capital of the island. Passing through the city gate, I went for some distance along pretty lanes bounded with cactus-hedges, no house being even in sight, and eventually found myself in the hospitable yamên of the British Consul. I stayed here some days, waiting for a vessel to take me across to the mainland, and spent my time pleasantly in making excursions to objects of interest in the city and visiting the few foreign residents in it. I went over the square Dutch fort in the city, on the gateway of which can still be traced the date "Anno —1650;" and also over the remains of Fort Zelandia at Amping, 3 miles off, on the sea-coast. It was being rapidly pulled down by the Chinese, in order that the bricks might be used in the erection of a grand new fort with four bastions, which was being put up under the superintendence of some French officers, a few miles off, to repel the Japanese and other invaders. I made a quick passage of twenty-four hours to Amoy, in an English merchant-vessel, and was rather sorry to leave Formosa.

Mr. J. THOMSON, on being called upon by the President, as one who had travelled in Formosa, and brought home a magnificent series of photographs illustrating the scenery and natives, said he hardly knew any spot in the world better calculated to illustrate certain phases of Physical Geography than Formosa. The great central ridge, running from north to south, was so elevated, and its distance from the sea so small, that during the rainy season the excessive drainage caused a rapid denudation of its slopes, and the consequent formation of a great delta on the west side of the island. The rate at which this delta had been deposited was attested by the natives at Tai-wan-foo. Not many years ago, ships could lie at anchor a mile or two miles from the coast there: at the present time they could not approach nearer than three or four miles. When the Dutch occupied the island—about the middle of the 17th century—Tai-wan-foo had a spacious harbour, referred to in the Dutch accounts, but it was now entirely silted up, and the distance from the former position of the harbour to the available anchorage was at present four or five miles.

The PRESIDENT said, when he was Her Majesty's Minister in China, he visited Formosa, and was very much struck by the luxuriance of its tropical vegetation. He believed that Mr. Veitch, and other botanists, had enriched our greenhouses with many beautiful orchids, and ornamental plants that they or their collectors had brought home from thence. When visiting the southern port, noticing that pine-apples were plentiful, he asked the Consul to send to the market to get a basketful, which he thought he might perhaps succeed in carrying to Peking, a voyage of ten or twelve days. The Consul said he need not send to the market, for one of his coolies could go out into the lane and gather them, as they grew wild, and had no money value. He did not know that they were equal to English hot-house pine-apples, but they were fine in growth and very pleasant to eat in that warm climate. Formosa would undoubtedly become a place of some importance, if it ever pleased God to give it anything like a decent government, and if colonisation advanced into the interior. At present it was merely fringed by settlers of the worst class of coast Chinese. It was badly governed by the officials sent there; but there was a middle class between the Chinese and the wild savages, who were semi-civilised, and would live peaceably if the Chinese officials on the coast, and the head-hunting barbarians in the interior, would give them the opportunity. At present, however, they passed rather an uneasy life. The climate was tropical, and although it had been contended that Europeans did not die more rapidly there than in other places, that was because they went away when they were likely to die. The English Consul in the north told him that it was very pleasant when the weather was fine, but that it rained incessantly for six months in the year. The island was rich in coal, which in the north was now worked with European machinery. This was likely to prove of very great advantage to steamers, and to the whole of the Strait trade on that coast. China also had an incalculable wealth in coal, but hitherto the Government had not seen its way to allow it to be worked. If the experiment, begun in the *corpore vile* of Formosa, succeeded, it might encourage them to proceed in a similar way on the mainland. The information obtained from time to time about Formosa showed that everything there was in its infancy. Rice, camphor, wheat, coffee, tobacco, tea, and sugar were all grown there; and no doubt other tropical produce would thrive, if there was a good government and colonists were encouraged to settle. As far as Europeans were concerned, however, he might say of it, as the Irishman said of Ireland, that it was the finest if not the healthiest country in the world—to live out of.

The following Paper was taken as read:—

3.—*A Trip into the Interior of Formosa.* By T. L. BULLOCK.

[ABRIDGMENT.]

WE started from Taiwanfoo, the capital of the island, in the month of October, 1873; the party consisting of Mr. Campbell, a missionary going to visit his native converts, Mr. Steere, an American naturalist, and myself, with our servants and porters.

For three days we marched in first a northerly and then a northeasterly direction across the flat and fertile plain, inhabited exclusively by Chinese, which forms the western part of the island. The third evening, just at the conclusion of our day's journey, we mounted a number of steep steps on to a platform or terrace, stretching out some distance from the hills. We were now passing from the plain country into the mountain district; and the part we were entering had never been visited by any foreigners except Mr. Campbell and a brother missionary.

The next day we travelled eastwards up a stony valley, which ran far into the mountains, continually fording the net-work of streams which descended it. In the afternoon we mounted a high and steep hill towards the north, covered with brushwood and long grass. As soon as we commenced the ascent our party was required to keep together and not straggle, as we had arrived in the country infested by the wild savages, though their nearest villages are many miles away.

When we crossed the ridge of the hill we entered suddenly upon another world. Before us lay a succession of peaks, of valleys, of mountain-sides, all covered with the bright green foliage of a dense forest. Between the trees there grew a profusion of plants, some with giant leaves, others with long leaflets, ferns and tree-ferns, and feathery bamboos. We passed the night in a small Chinese settlement in a neighbouring valley.

Next morning an hour or two's walk through the forest brought us to a small lake. Here we dismissed our Chinese porters, who were to return to Taiwanfoo with the first party they found leaving the mountains; and we ourselves embarked in two canoes, and were paddled down to the village at the further end. The lake is crescent-shaped, about three miles long, with numerous little bays or indentations between the spurs that run down from the mountains. The mountains are steep and high, and wooded from the base to the summit. At the head of the bays there are little patches of flat ground, irrigated by the mountain-streams, and cultivated with rice. There are also a few spots on the more gentle slopes, where tea and rice and sweet potatoes are grown in small clearings. A certain number of Chinamen live round the lake, and a small tribe of savages, called by the Chinese Tsui-hwan, or "water-savages." The tribe is now very small, consisting of between 100 and 200 families. It has its own customs, language, and dress; and it is said by tradition to have been once much more numerous and powerful than now, and to have possessed a considerable tract of country. The aborigines of Formosa are divided broadly into wild savages and friendly savages. The former are the inhabitants of the higher mountains, whose hand is against every man: the latter those dwelling on the edge of the plain, and near to the Chinese, who are inoffensive, and are too civilised to really deserve the name of savages. The Tsui-hwan, excepting that they live at peace with their neighbours, deserve to be classed among the wild rather than the friendly aborigines. They are a good-looking and well-made race, without being very tall or powerful, and are fat and healthy. Their skin is of a light reddish-brown colour. Their hair is long, black, and straight. The women are quiet, happy, and pleasant-looking. Their hair is parted in the middle, thrown back, and tied behind. The favourite occupation of the Tsui-hwan is hunting. Every man can handle a gun, which, however, only the richer possess, and a bow and arrow. They carry a long, pointed knife, thick and heavy enough to be used as a chopper. I found afterwards that it was the custom of all the aborigines, of whatever tribe, to carry a knife of this kind. They have various modes of fishing, among others, one by torchlight; but they did not employ it at the season when we were at the lake. We once saw a man fishing from a canoe with a bow and arrow, and a fish he had just caught. The head of the arrow was like a four-pointed fork. They also employ themselves to some small extent in tilling the land, either for themselves or for their Chinese neighbours, who now possess the greater part of that which is cultivable round the lake. Their houses are built of wood, and consist only of one large and high room, which is inhabited by several families, or perhaps by several couples belonging to the same family.

With the help of a few native men and boys, we compiled a list of words in their language I afterwards compared this and some similar lists, obtained at different times, in other Formosan languages, with some lists of words in various Malay languages, and found a very large number of words identical or resembling in the two.

The next morning we started off, and travelled in a northerly direction for about 15 miles. The path lay along the valleys, crossing no high pass, but with many short and steep ascents and descents. The country was entirely covered with forest, excepting a few of the wider valleys, which had been cleared by Chinese settlers and planted with rice. The end of our day's journey was at a place called Posia, where we took up our abode in the little Mission-house of a Christian community.

Posia is a flat oval plain, about five miles long and four broad, surrounded by the mountains on all sides. From the western end of it one sees towards the east the lofty peaks of the great central range, 10,000 to 12,000 feet high; and from the eastern end one sees line upon line of hills far away to the west, showing how far one has penetrated into the mountains. There are a good many Chinese living in the various villages of Posia; but the bulk of the population, some two or three thousand, are aborigines, belonging almost entirely to the tribe called Sek-hwan, a name composed of two words meaning tame or friendly savages. The Sek-hwan, in point of civilisation, are equal to the lower orders of Chinese, but are more simple and less cunning. Having lived outside the mountains on the edge of the plain before they migrated comparatively recently to Posia, they must have been in close intercourse with the Chinese during some centuries. They subsist principally by agriculture; but though tolerably good farmers, they are not in this respect the equal of the Chinese. They are passionately fond of hunting, which they pursue sometimes singly, sometimes in large parties, whenever they have the necessary leisure. The game they kill consists of three kinds of deer, wild boar, squirrels, monkeys, pheasants, flying squirrels, and occasionally panthers and wild cats. Fortunately for themselves, they have no taste for opium; but they are fond of wine and spirits, in both these points resembling the rest of the aborigines of the island. The rice-wine, however, which they make is so weak that they very seldom beome intoxicated. In appearance they differ considerably from any other aborigines that I have seen in Formosa. They are taller, slighter, and rather fairer. They have large dark eyes, and wide mouths, with long and projecting upper teeth. The men wear short trousers and jackets, differing but very little from those worn by the Chinese. Their hair is tied in a knot at the back of the head, after the fashion of the Chinese before the introduction of pig-tails by the present dynasty. The women fasten their back hair in a knot and comb the front hair down over the forehead, cutting it in a line just above the eyes.

The English Presbyterian missionaries have met with great success among the Sek-hwan of Posia. Though the Mission has been opened but a short time, there are sixty baptized Christians, and about four hundred regular hearers.

A long day's march to the east of Posia, high up on the mountains of the central range, lie the villages of the Boo-hwan, a large tribe of wild savages. When they are at peace with the inhabitants of Posia, that is to say, when they have not murdered any of the latter very lately, a small amount of intercourse is kept up between the two districts. Some two or three Sek hwan traders, who are well known to the Boo-hwan and speak their language, are allowed to go into the villages of the latter to trade; and a few of the Boo-hwan come down to the border-villages of Posia for the same purpose. The articles brought down by the Boo-hwan are principally skins and deer-horns, and pieces of grass-cloth and embroidery, which they exchange for gunpowder, salt, red calico, and iron work.

After many days' delay, we prevailed on the trader who had interpreted for Mr. Campbell to accompany us on a visit to their people. Our party consisted of our three selves, the interpreter, two porters, a servant, and a Boo-hwan woman, married to a Sek-hwan of Posia. Though we had two porters we had hardly any baggage, as the country was too rough for a man to be able to carry more than a few pounds. Our route lay due east, up a long valley with steep and lofty sides; that to the south covered with dense and almost impenetrable forest, full of prickly climbing plants; that to the north covered with high grass, and a few pines and oaks. After a short day's march we arrived at some small clearings and cultivated patches, with a few temporary huts. The one or two Boo-hwan living there declined to take us on to the villages, but offered us a night's lodging. As the hour was late, we accepted the offer. A few pieces of sweet potato and taro, and a mess of pounded rice and millet, were given us for dinner. The hut allotted to us being too small to accommodate all our party, and very dirty, we gave it up to our servants, and slept on the hill-side under a small granary raised on posts about 3 feet from the ground. The next morning after breakfast the native woman went back, and the rest of us continued our journey. The valley soon narrowed into a deep gorge, with no semblance of a path, up which we scrambled along the rocks or through the water as best we could. After midday we halted and ate a little rice, and then commenced the ascent of a long and extremely steep hill, halting frequently to rest the porters. On a plateau near the top we passed a few patches of millet, and one of China grass; and we could see similar plots dotting the upper part of the hills on the opposite side of the valley. At last we reached the summit, and found ourselves in a village situated on the ridge of the central range, perhaps some 5000 feet above the sea. At first there were not many people about; but those we saw received us in a friendly, though not in a cordial, manner. Not long after we arrived, when strolling about the village and looking at what was to be seen, we discovered a row of skulls laid out on a raised board in front of one of the houses. There were no less than twenty-five of them, a few not yet bleached, others evidently many years old. We paid a good deal of attention to this display, and one of the party sat down and took a sketch of it. This, and our staring, put the savages into a bad and suspicious temper, which frightened our guide, who insisted upon our sitting down quietly instead of looking about. Our servant now became so terrified, either at what the guide said or at the looks of the savages, that he became perfectly useless, and was only fit to sit in a dark corner during the remainder of our visit. We took a seat in front of one of the houses, and, to produce a better impression, we brought out some packets of needles and made presents from them to the women. Some men who had wounds or sores now applied to us for medical aid. Having a bottle of iodine, we painted the wounds with it, to the great satisfaction of our patients. After a time we went to have a look over the back of the hill towards the east. We saw a long valley running in that direction, and then more mountains; but we were too much shut in to see the sea, or to get a very extended view. One of our party wandered a little way off into a neighbouring grove, which was used for a cemetery; and cries of horror were raised when his presence in it was discovered. On his return a small quantity of dust was poured on his head to purge him. One of the savages gave up to us his hut for the night, and after dinner we had a large audience of both sexes and all ages. The room was lighted by the fire and by knots of resinous pine burnt on a low stool. More men came to have their wounds dressed. Indeed, nearly every man in the village seemed to have abrasions of the skin somewhere. All who liked were allowed to smell at a bottle of ammonia. The extremely energetic way in which they showed their astonishment afforded the greatest amusement to the lookers-on, and everyone seemed to be in the best of humours again.

Next morning we made various presents in recompense for our entertainment, and set off in good time upon our homeward journey. We descended the big hill in less than a quarter of the time we took to ascend it, and soon afterwards came upon a small party of armed savages sitting in the road, who got up and followed us. Then a few more overtook us from behind; then a few descended the hill on our left, then some on our right; then we came on a chief and a stronger party. All we saw joined company with us; till at last we were marching along surrounded by thirty or forty men in war-dress, and armed with spear and knife. As they did not seem particularly friendly, matters looked rather unpleasant, and we did not know what might be coming. We tried to let them get ahead of us: but when we loitered, they did the same; so we had nothing to do but go on steadily. Our guide spoke neither to us nor to them, but led the way in front of everyone, walking fast. At length, when we had got past their last clearing, but were still some miles from the edge of what they consider their territory, some of them began to drop behind, and in a little while the main body halted, while we continued our march alone. We reached Posia shortly before dark, after nearly nine hours' hard walking.

The Boo-hwan savages are of small stature, with good chests and shoulders, but their muscles, excepting those of the legs and thighs, are very little developed. Their faces are pleasing, rather mild than fierce, generally intelligent-looking, and not unfrequently handsome. The wild savages I have seen of two or three other Formosan tribes further south are of a darker red, and of a coarser and less agreeable appearance. In warm weather they wear absolutely no clothes, but some have a small handkerchief tied round the waist with the ends hanging loose in front. They are tattooed across the lower part of the face, with a broad band of net-work passing from the ears under the nose and covering the chin. They have also a few small marks on the forehead, made when they are children. The broad band is tattooed at marriage. The men have a line an inch broad down the forehead and continued on the chin. The women weave a strong and useful kind of canvas from China grass. They also make some rather tasteful embroidery, taking the canvas for a base, and unravelling blue or red calico to obtain the thread for working with. Their houses, which are built of flat stones without mortar, consist of one large room. The floor is two or three feet below the level of the soil. They have no window and a small door, so that they are very dark even in the daytime.

The wild savages in Formosa seem to carry on the practice of man-hunting out of mere devilry and for the sake of obtaining skulls. They kill all alike, Chinese and aborigines, except those of any tribe with whom they may be anxious to keep on good terms at the moment. They leave home in parties of generally from ten to twenty, armed with spears and knives, not with guns, and carrying a small bag of boiled rice on their backs. They sometimes go for as much as two or three days' march till they reach the edge of the frequented spots. Here they lurk about the forest, sometimes cutting off a man working alone in his field, sometimes falling upon a band of travellers whom they are strong enough to master. They never attack unless they think themselves the strongest, and, so thick is the forest, they never show themselves but at the moment of attacking. When their provisions are exhausted, or they have obtained a head, they return home. In the latter case a feast is organised. The skull is roughly cleared out; wine is poured in, and it is handed round for the company to drink from.

Two days after our return to Posia we started on our homeward journey, going due west, and taking the usual road of communication between Posia and the plain.

Ninth Meeting, 26*th March*, 1877.

SIR RUTHERFORD ALCOCK, K.C.B., PRESIDENT, in the Chair.

PRESENTATION.—*James Coate, Esq.*

ELECTIONS.—*Hon. Cecil Ashley; Jonabad Finch, Esq.; Alfred William Goodman, Esq.; John Griffin, Esq.; Cornelius Herz, Esq.; Robert George Lutley, Esq.; James Macalister, Esq.; John William Reed, Esq.; Edwin J. Richardson, Esq.; Henry Robertson, Esq.*, M.P.; *John Rutson, Esq.; James Benjamin Scott, Esq.*

DONATIONS TO THE LIBRARY, 12TH TO 26TH MARCH, 1877.—The political economy of Indian famines, by A. H. Browne; Bombay, 1877 (*Author*). South Australia; Proceedings of the Hon. Thos. Elder's expedition under command of Ernest Giles, from Perth to Adelaide, 1875–6 (*The Governor of Victoria, per H.M. Under-Secretary of State for Colonies*). Verslag over de Voorwerpen door de Nederlandsche Zeevaarders na hunne Overwintering op Nowaja-Semlja, &c., door J. K. K. de Jonge, with photograph of relics of Barentz discovered by Charles Gardiner, Esq.; s'Gravenhage, 1877 (*His Excellency W. F. Van Erp Taalman Kip, Netherlands Minister of Marine*). Annaes da Commissão Central permanente de Geographia, No. 1, Dec. 1876 (*The Central Committee of Geography, Lisbon*). Archivos do Museu Nacional do Rio de Janeiro, vol. i., pts. 1–3 (*The National Museum, per M. Ladisláu Netto*). Notes on the country between Kilwa and Tanganika, by James Stevenson; Glasgow, 1877 (*Author*). Indberetning om den af Prof. Johnstrup foretagne Undersögelsesreise paa Island, 1876, and Om Grönsandet i Sjælland, af F. Johnstrup; Kjobenhavn, 1876 (*Admiral Irminger*). Select plants eligible for culture in Victoria, by Baron F. von Mueller; Melbourne, 1876 (*Author, on behalf of the Victorian Government*). Remarks on recent Ocean explorations and the current-creating action of Vis-inertiæ in the Ocean, by W. L. Jordan, 1877 (*Author*). Three Grammars and vocabularies of the Yoruba language, 1843–52, and one of the Nupe language, 1864, by Samuel Crowther; Vocabularies, &c., of Six East-African languages, and of the Kisuáheli, Wakuafi, and Galla languages, by J. L. Krapf, 1842–50; Grammars of the Vei and Bornu languages, by S. W. Koelle, 1854; Grammar of the Ibo language, 1861, and Vocabulary and Dictionary of the Haussa language, 1843 and 1876, by J. F. Schön; Vocabulary of the Masai-tribes language, by J. Erhardt, 1857; Grammar of the Temne language, by C. F. Schlenker, 1864; Grammar of the Amharic language, by C. W. Isenberg, 1842; and Grammar of the Fuldo language, by C. A. L. Reichardt, 1876 (*The Church Missionary Society, per E. Hutchinson, Esq.*, F.R.G.S.); and the current issue of publications of corresponding Societies, Periodicals, &c.

DONATIONS TO MAP-ROOM, MARCH 12TH TO 26TH, 1877.—Eleven maps from Petermann's Geographische Mittheilungen (*Dr. A. Petermann*). Map of Tierra del Fuego, showing track of M. Pertuiset (*M. Pertuiset*). 602 sheets of Ordnance Surveys of Great Britain on various scales, and 57 Area Books of Parishes (*First Commissioner of H.M. Works and Public Buildings, through Major-General Cameron, Director of Ordnance Survey*).

The PRESIDENT, before proceeding to the immediate business of the evening, alluded to the great loss which the Society had sustained by the death of Admiral Sir Edward Belcher. He was one of the oldest Fellows of the Society, and for half a century was distinguished as a scientific navigator and nautical surveyor. He was associated with some of the early explorations in the Arctic Circle, and some years later commanded one of the expeditions which were sent in search of Sir John Franklin. About twenty or thirty years ago he (Sir Rutherford) met him in China, and in fact there was no coast in any quarter of the world where he had not done valuable work, and proved his scientific accuracy, and the laborious mode in which he carried out his surveys. Such men were not easily replaced. There were but few in a generation, and when one of them passed away, those who knew what they had done were bound to pay them the tribute of affectionate regret.

The special business of the evening was the Paper that had been announced on Smith Sound by Captain Sir George Nares. When the Society first gave a cordial welcome to the officers of the Arctic Expedition at St James's Hall, they were informed that as it would be impossible on that occasion to enter into any discussion, another opportunity would be afforded for Members who were inclined to discuss the geographical results that had been achieved. The present evening had been therefore set apart for that purpose.

The following Paper was read :—

On the Navigation of Smith Sound, as a Route to the Polar Sea.

By Capt. Sir G. S. NARES, R.N., K.C.B.

MY present Paper on the navigation of Smith Sound will, I trust, be accepted as a continuation of the one on the Polar Area, which I recently had the honour of reading before this Society; rather than as being in itself an exhaustive description of the locality.

Our knowledge of the water-passage leading from Baffin Bay to the northward into the Polar Ocean, is derived from observations made by explorers who have passed eleven summers and six winters in the neighbourhood.

Of the four Expeditions specially equipped for the exploration of Smith Sound, three were despatched from the United States and one from this country.

In 1852, the present Admiral Inglefield visited the entrance of the Sound, and discovered the south shore of Grinnell Land; also that the coast of Greenland, north of Cape Alexander, trended to the north-east for a considerable distance, but he did not land on either shore.

In 1853, Dr. Kane, with his small sailing-vessel, was the first who succeeded in forcing a passage within the sea; but, after a most determined and spirited struggle, he was finally imprisoned by the ice in Reusslaer Bay for two winters. From there one of his sledge-parties, under Morton, explored the Greenland shores to Cape Constitution; and another, under Dr. Hayes, landed on Grinnell Land; both journeys displaying the very highest qualities in all engaged in them.

He was followed in 1860 by Dr. Hayes, who, unable in his sailing-schooner to enter the sea, was forced to winter in Port Foulke.

In the following spring, after a most harassing and determined march across the heavy Polar pack in Kane Sea—over which he found it impossible to drag his boat—he ascended Kennedy Channel; making one of the most brilliant Arctic sledge-journeys on record.

In 1871, Captain Hall, in a small steam-vessel, made his very successful run to the head of Robeson Channel, where he was stopped by ice, and forced to winter in Polaris Bay.

From thence, sledge parties explored to the northward of Newman Bay; but, like all previous travellers except Sir Edward Parry, they were unable to drag their navigable boats over the rough ice. On her return voyage, the *Polaris* was caught in the pack and driven into Lifeboat Cove, where she was obliged to be run on shore.

In 1875, the most powerful Expedition of all, consisting of two steam-vessels, admirably equipped, was sent out from this country under my command.

We succeeded in reaching the head of Robeson Channel, where we were stopped by the ice, and passed the winter on the west shore of the channel.

Sledge-parties explored the whole of the neighbouring shores, and determined the existence of an extensive sea; but, like all our predecessors, we were unable to transport navigable boats for any great distance across the ice, away from the land, during the short season when exploration by means of sledging is possible.

The coast of Greenland bordering Smith Sound, so far as can be sighted from the sea, lies completely imbedded in ice—in summer as well as in winter—without one mountain-peak showing itself above the very slightly inclined skyline of perpetual ice.

The glaciers descending from this ice-cap are, however, mostly melted before reaching the coast, leaving a border of land clear of ice near the sea.

Hartstene Bay, situated at the head of Baffin Bay, on the Greenland shore, is washed by a warm current coming from the southward; and is protected from the cold Arctic flow by the projecting promontories, which form the western capes of Greenland. In consequence, the neighbourhood, as first pointed out by Dr. Hayes, enjoys a comparatively mild climate; and on the vegetated lands fronting the ice-cap, as well as in the neighbouring sea, Arctic life is found in its greatest abundance.

As experience shows that, in all but very exceptional seasons, the position can be yearly visited from the southward, the neighbourhood forms a valuable and important base for exploration in more northern latitudes. It is, in fact, the most northerly position, where an abundance of game is procurable by experienced hunters within a restricted area. At no other northern position yet explored is game now to be obtained in sufficient quantities to enable even a party of Eskimo to exist throughout the year on their own resources.

On the opposite coast of Ellesmere Land, on the west side of the channel, the country in the interior is not so completely buried in ice as the Greenland hills, and the mountain-tops all project above the ice-cap.

South of Cape Sabine, the glaciers on the hill-sides extend into the sea, and few bare places are left fit for feeding-grounds; but northward of it, along the southern shores of Hayes Sound, the line of perpetual snow and ice—as on the Greenland coast—is at a considerable height above the sea-level; consequently the glaciers, instead of extending to the sea, are fronted by vegetated valleys, and heights free from ice.

One spot partially explored by the late Expedition—Twin Glacier Valley and the heights about Alexandra Haven—exhibited many recent traces of Arctic life; and the numerous ancient Eskimo remains found there would denote that game had always frequented the neighbourhood.

An exploring party travelling up the Sound, on the interesting duty of ascertaining whether a water-passage exists extending to the Western Sea, may therefore expect to obtain a small supply of fresh food on the south coast of Grinnell Land. North of Hayes Sound, the mountains are remarkably free of any ice-cap; the valleys contain small glaciers; but extensive tracts of land are free from snow during the short summer, yet the locality is decidedly unfavoured by game. While our ships were detained by the ice near the coast, only a few hares and ptarmigan were obtained. Sledge-travellers will be unusually fortunate if they there obtain any game at all.

In Rawlings Bay, at the south entrance to Kennedy Channel, a few ancient decayed musk-ox bones were found; but I think that few of these animals wander so far away from the more favoured grazing-grounds in the large valleys near Mount Grant, in the United States Range. As we advance to the northward, up Kennedy Channel, the sea-life rapidly diminishes, and the bears who prey upon it are found in ever-decreasing numbers. At Polaris Bay, where the winds and currents contribute to keep the water-spaces more open than elsewhere, a few seals and sea-birds congregate during the summer. North of Robeson Channel, few, even of these, are met with, and the bears and dovekies are quite left behind.

Throughout the whole area north of Smith Sound the migratory birds in small numbers rear their young in the favoured valleys and plains during the short summer.

The nearer we approach the Pole, the later in the season does the sun make its appearance, and the lower the altitude it attains at noon. Consequently, the spring and the reanimation of the non-migratory Arctic life are more backward than in more southern latitudes.

At the Pole, the birds can have very little time to spare between the late spring and the returning autumn frosts in which to rear their young. So pressed are they for time that, as I have already related, many that visited Floeberg Beach, finding the season more backward than they anticipated, were obliged to return to a more favoured locality farther south. Thus I reason, that as we advance to the northward, less dependence can be placed on obtaining an appreciable supply of winged fowl.

With regard to migratory birds in high northern latitudes, it is remarkable that the men of our party who resided at Polaris Bay during July and August, the best season for game, and who were extremely anxious to obtain a supply for the use of their sick comrades, were unable to find birds in as great numbers as the crew of the *Polaris* had found them at the same place. And I cannot but conclude that the birds resort yearly to the same locality for the purpose of breeding, and that when they are all shot down in any one neighbourhood, it takes some years before that neighbourhood becomes fully stocked with game again. This opens up the question as to whether the large number of necessarily ruthless sportsmen who last year hunted the district between Lady Franklin Sound and Cape Joseph Henry have not for a time devastated that district by destroying all the parent birds.

The same consideration will apply to musk-oxen; for Hans, the Eskimo, who was the most successful hunter on board the *Polaris* in 1872, could find none of those animals on the same feeding-grounds in 1876.

It will be convenient if we consider the district under discussion as consisting of two narrow channels, Robeson and Kennedy Channels; and two broadened parts or seas, Hall Basin and Kane Sea, with Smith Sound or Strait as an outlet into Baffin Bay. During the navigable season, that is during August and the first week of September, after the ice has broken up, and is drifting about at the mercy of the winds and currents, in consequence of the prevailing winds coming from the westward and the ocean-current from the northward, the shores of the channels and seas having a north-westerly aspect are more liable to be encumbered with ice for long periods than those with a southerly or easterly one. This consideration, coupled with the knowledge that Dr. Kane, although working with remarkable patience and perseverance, was unable to force his way beyond Reusslaer Bay, on the south-east shore of Kane Sea, and was imprisoned there the following season, owing to the ice in the neighbourhood never permitting him to move, determined me, both when going North and returning, to keep on the western shores as much as possible.

In a channel of varying breadth, owing to the strength of the winds, tides, and ocean-currents being greater in the contracted than in the broad channels, the ice is more readily carried away out of the narrows and deposited in the more sluggish waters of the broadened parts.

Thus, in Kennedy Channel, there is comparatively a free navigation throughout the summer; while in Kane Sea there is a great accumulation of ice, with a constant influx at the north end, and a discharge into Baffin Bay at the southern entrance. At the latter point, where the ice is first met with when coming from the southward, as the current runs stronger in the offing than inshore; the southern edge of the ice, extending across from Cape Sabine towards Littleton Island, assumes a horse-shoe shape, curving to the northward, with a water-space in mid-channel, from whence the ice is readily carried to the southward. Thus, vessels arriving from Baffin Bay are usually able to penetrate for a short distance farther north in this bight than they can do by keeping among the more closely-packed ice inshore; but they are sure sooner or later to meet the southern edge of the main pack-ice in Kane Sea. It can only be in very rare seasons that the water-bight can extend so far north as to communicate with the more open sea in Kennedy Channel.

It is a mistake to suppose that the *Polaris* did not encounter ice in this part as she ran to the northward. From a position near Littleton Island, she steered a direct course for Cape Fraser; but found that she was running into a bight in the ice. Captain Hall then turned to the south-west, and, rounding the edge of the pack, passed up to the northward close along the western shore, through a water-channel existing between the pack and the land, in the same manner as the *Alert* and *Discovery* did; the only difference being that while we had to fight for every mile, the *Polaris* fortunately found a continuous channel, probably owing to a previous westerly wind.

In Hall Basin there is an accumulation of ice similar to that in Kane Sea, with a few open-water spaces in the narrowest part of

Robeson Channel. But the large stores of ice in the Polar Sea to the northward, and in Lady Franklin Sound to the westward, readily movable by the prevailing wind, renders the navigation of this part even more difficult and dangerous than in the larger but somewhat similar Kennedy Channel.

In conducting a vessel to the northward, the greatest difficulties may be looked for when passing along the shores where the pressure of the current sets against the land. This is particularly the case near the southern exit to the two broad seas, Hall Basin and Kane Sea. Happily both are furnished with good and convenient harbours.

Cape Sabine, a difficult point to pass, has Port Payer most advantageously situated for use as a resting-station while waiting for a westerly wind to blow the ice out of Hayes Sound and open a passage to Victoria Head and to Grinnell Land. If stopped on the way by the ice, the grounded icebergs in the indentation on the east side of Bache Island will afford a slight amount of protection; but, after leaving Port Payer, Norman Lockyer Island and Walrus Shoal are the only secure resting-places until Bessels Bay or Discovery Bay is reached; both of which are valuable harbours, although the former is much encumbered by icebergs.

The open bays on the south-east coast of Grinnell Land, owing to their large size, afford very little protection to a ship. In the early season they are generally filled with one season's ice of ordinary thickness, in which a dock may be cut when the ship is compelled to wait; but by the middle of August, the height of the navigable season, this bay-ice has generally broken up and drifted out, giving place, when the wind blows on shore, to the heavy Polar ice from the main channel.

Wherever large icebergs have grounded in clusters near the land —as is the case inside Washington Irving Island, north of Hayes Point, and in Joiner Bay—if the ice inshore of them has broken up and drifted out of the way, they often afford convenient protection from immediate danger when the outer ice closes in. At other parts, such as Maury Bay, small ones become stranded, and are useful as fixed stations to which the ship may be temporarily secured; but if the outer ice closes in with force, both the ship and iceberg or floeberg, whichever it might be, would be forced upon the shore. With this consideration, a light draught of water is of the utmost importance in an Arctic vessel.

North of Baffin Bay, ice-saws are only of use when meeting with the one season's icefloes of from 3 to 6 feet in thickness, which have been formed in the bays during the previous winter. The usual saw is far too short to make any impression on the thick ice found in the main channel, most of which has drifted to the southward out of the Polar Ocean.

Also, as steamers are called upon to navigate through very close ice and through channels only as broad as themselves, there is very little time given to think of docking, the greatest judgment is required by whoever is in command; and the danger of the ice nipping together must be somewhat disregarded, if any advance at all is desired.

To the northward of Cape Sabine, the only discharging glaciers are those in Dobbin Bay and Rawlings Bay on the Grinnell shore; and in Peabody Bay and Bessels Bay on the Greenland coast. The icebergs broken off from the front of the discharging glacier which completely fills up Petermann Fiord are so small, that it cannot be considered as in any way affecting the navigation of the district. In Robeson Channel, and in the Polar Ocean to the northward immediately in its neighbourhood, there are no icebergs. Of those which escape out of Bessels Bay, a few drift towards the north, and become stranded in Polaris Bay, where one sheltered the *Polaris* during her winter stay. The greater number drift at once to the southward through Kennedy Channel, without grounding, owing to the depth of the water and the strength of the current. There are few icebergs met with in mid-channel north of latitude 80° N. South of Rawlings Bay, where the channel expands into Kane Sea, they become stranded, and stud the shores on both sides. A navigator passing a cluster of these carefully notices the amount of protection it would be capable of affording, were he forced to retreat by the ice closing in ahead.

Kane Sea is thickly studded with floating icebergs. All the large ones derive their birth from the Humboldt Glacier, and their drift readily marks the general movement of the ice. From the high land about Cape Louis Napoleon, 2000 feet above the sea, the heavy chain of bergs in Peabody Bay fronting the Humboldt Glacier—through which Morton from Dr. Kane's vessel had such difficulty in advancing when making his splendid journey to the north—is distinctly visible at about 50 miles' distance. A few of these drift across to the western shore, but the majority are carried to the southward on the east side of the channel. On all occasions those which are driven into the offing indicate the faster drift of the main body of the ice in mid-channel compared with that nearer the shore. This is also well shown by the drift of the *Polaris*. Caught by the pack and borne onward by the full strength of this current, she drifted from the south entrance of

Kennedy Channel, in an almost direct line, to the neighbourhood of Littleton Island—between the middle of August and October—a distance of 120 miles in sixty days. Her drift also shows that, although all regular navigation is over for the season by the middle of September, the ice is not firmly frozen before October or November; but after the latter month all motion ceases except in the very narrow channels.

A strong current, even when the temperature of the water is very low, is a powerful agent in retarding the formation of ice, and in preventing ice once formed increasing in thickness as fast as it would if the water were stationary. It also decays and destroys the ice before the power of the sun is able to make itself felt.

In Bellot Straits, leading westward out of Prince Regent's Inlet, where the tide runs with great rapidity, Sir Leopold M'Clintock informs us that the water remains unfrozen throughout the winter. In other narrow channels the ice only attains a minimum thickness, even during the coldest weather. Early in the spring, long before the temperature rises above the freezing-point, the ice in the narrows decays and polynias are formed surrounded by fixed firm ice.

I therefore reason that because Robeson Channel was open nearly all the winter of 1871–72, it does not necessarily follow that the ice in the Arctic Sea was also in motion at the same time, and yet I cannot take upon myself the responsibility of suggesting that the ice in that sea always remains unbroken and quiet as late in the season as it did last spring, that is, until the middle of July. Were we perfectly certain that the ice in the Polar Ocean always remains stationary until even the end of June, sledges unprovided with boats might be despatched towards the north, and the possibility of reaching a higher latitude would then be very considerably increased.

It must be gratifying to all interested in Arctic matters to hear that in the United States it is contemplated to send out another Arctic Expedition to extend our knowledge of these seas, which may be said to peculiarly belong to themselves. There is still a wide field there for geographical and scientific research; but I am afraid that great difficulty will be found in advancing much nearer to the Pole by the Smith Sound route than has already been attained, either in a ship, or by boat, or sledges, unless, indeed, the coast of Greenland—contrary to my expectations—trends to the northward beyond lat. 83° 20′ N.

Admiral Sir RICHARD COLLINSON said his experience of the Arctic Regions had been confined to a different part from Smith Sound, but there were some statements in the interesting Paper which had just been read, which he could corroborate from what he had himself seen. Many years ago Captain Parry pointed out that in order to explore the Arctic Regions it was necessary to stick to the land; never had that been more strongly proved than by the late Expedition. Not only must the explorers stick to the land, but, as Sir George Nares had said, they must find out which was the weather shore. The Paper had referred to the fact, that in certain portions of the Arctic Regions animal life was so rare that probably one or two expeditions would completely exhaust it. His own experience confirmed that view. Sir Robert M'Clure, Captain Parry, and Captain Kellett found musk-oxen and deer in abundance on Melville Island, and the north end of Banks Land, but he (Admiral Collinson) following the coast of America, and being continually in the neighbourhood of the Eskimo, though much further south, only saw one live musk-ox, and obtained but a small number of deer. It would therefore be a mistake for future travellers to expect that they would be able to support themselves on fresh meat. The occurrence of pools of water in some places, and the continual motion of the ice was a most interesting fact, and one which must be well studied by any succeeding explorers in the Arctic Ocean. Baron Wrangel, proceeding to the northward of Siberia, came upon water in the early spring, and was prevented from continuing his journey by the sledges falling through the ice. On the other hand, during the winter he (Admiral Collinson) spent on the north coast of America he never saw a single crack or movement of the ice. It was difficult to account for the open water in the regions north of Siberia, which were supposed to be the most inclement part of the world. Wherever there was a projecting headland, such as Point Barrow, and the coast trended away, the ice, affected by the water of the spring-tides, and by the wind, broke off. This accounted for the presence of open water which was frequently seen by H.M.S. *Plover* during the winters which she spent there, and it had led people to believe in the existence of what were sometimes called polynia. The term polynia, however, merely meant an open hole extending for a short distance. If any attempt were made to go through the ice because of the presence of these holes, the vessel would get into the same difficulty as the *Tegethoff*, and be entirely dependent upon the current. There was one thing, however, which should always be remembered by Arctic voyagers, and that was that the time of greatest danger was often the very moment of safety.

Admiral RICHARDS, as one of those who were in some sense responsible for the route taken by the late Expedition, said it was very well known before that Expedition sailed that there was a divergence of opinion as to the best means of reaching the Pole; but there was no difference of opinion as to Smith Sound being the best route for such a sledging expedition as was proposed. There had been very good reason to believe that land extended a considerable distance beyond the most northerly point reached by the *Polaris*, and that that land trended northward. Had that been so, there could be no question but that the late Expedition would have reached a much higher northern latitude than it did. If the coast-line, which was explored to the west and to the east, were turned north, it would extend nearly to the Pole. It must, however, be admitted now that if the discoveries of the *Alert* and the *Discovery* had been known previously, those vessels would certainly not have been sent to Smith Sound, because every Arctic traveller knew perfectly well that it was quite impossible for sledge-journeys to be carried out to any great extent where there was no land along which the sledges could be dragged. So soon as Sir Geo. Nares found that there was no land to the north, he knew it would be impossible to reach the Pole, and therefore he explored east and west, which was all that was left for him to do. Smith Sound must now be regarded as a closed route to the Pole by sledges, and he knew of no other available sledge-route. He did not say that there would never be any more sledge-expeditions; but he maintained as strongly as possible that sledge-travelling with a view to reaching the Pole was at an end for ever. The longest distance ever accomplished by any one sledge-party, or by any combination of sledges, in one direction, did not exceed 360 geographical miles in a straight line, and that distance had only been travelled by one party, under exceptionally favourable circumstances. Three other parties had made on the outward journeys about 300 geographical miles. Of course the necessity of deviating from the straight line, to avoid rough ice, made the actual number of miles travelled much greater, but 360 geographical miles was the longest distance ever passed over in a straight line by any sledge-party on their outward journey. Proposals had been made for extending such journeys by means of balloons or steam. The idea of ballooning may be at once dismissed, but the use of steam would appear very feasible to many persons. Steam had overcome all difficulties of locomotion but this one; and if an unlimited extent of ocean solidly frozen over could be found, no doubt a traction-engine could traverse it; in fact, a railway train could go over it easily. But such a solid ocean had never yet been discovered away from the neighbourhood of land, and in fact never could be. He therefore need not say what would be the fate of a traction-engine if it got upon thin ice or into a hole. The Americans appeared to have an intention to colonise Lady Franklin Bay. He wished them success in so original an enterprise, for none were more entitled to it; and if they carried it out, some very remarkable results no doubt would ensue; but he was bound to give a decided opinion that no expedition would ever reach the North Pole, or approach near it, by a sledge-expedition through Smith Sound.

It should be remembered that sledge-travelling was not introduced to discover new land, but rather to search for the missing crews under Sir John Franklin. Such a mode of travelling never would have been adopted to discover new land in the Arctic Regions, at the rate of three or five miles a day. He believed it had been brought to the highest pitch of perfection of which it was capable while human beings were constituted as at present; but it did not follow from what he had said—and he should be very sorry to think it did—that the North Pole could not be reached. Twelve years ago Dr. Petermann, who has been the constant and consistent advocate of reaching the Pole by the Spitzbergen route, communicated his views to the Society in two letters to the President, which were read and printed in the 'Proceedings' of that date. He supported those views by evidence to my mind the most conclusive short of actual experience, that is, by the most industrious and persevering research on the subject of isotherms and other physical phenomena. I see here this evening Arctic officers who were in accord with Dr. Petermann on that occasion, and I repeat what I said then, that no papers I have heard read before the Society on the subject of reaching the Pole have appeared to me so sound, so logical, or so convincing, as those papers of Dr. Petermann's. The subject was a speculative one then, more than it is now; but the papers have stood the test of twelve years, and they force themselves more on my conviction now than they did even then. Briefly, the proposition was that two stout and well found steamers, such as the *Alert* and *Discovery*, should seek an opening through the ice north of Spitzbergen, an attempt which has never yet been made. It is the only route which offers a prospect of success by ships, and it is impossible to deny that it does hold out a very fair prospect. It could be effected in one summer, and if unsuccessful could be resumed the next. It need not involve a winter in the Arctic Regions, though I should much prefer, if necessary, to pass one at Spitzbergen, where it might be spent profitably and not unpleasantly.

Admiral **OMMANNEY** said, after the very interesting Paper which had just been read, he thought the country had been fully rewarded for the expense of the late Expedition. With regard to geographical results, the termination of

Grant's Land had been ascertained, and perhaps the termination of the great continent of Greenland, while for the first time the real Polar ice-sea, lying between 80° and the Pole, had been visited. He did not think that Parry ever came near that great massive ice which has been discovered on this Expedition. He quite agreed with Admiral Richards as to the impracticability of reaching the Pole by sledges; and he believed that the conditions of the North Pole were somewhat similar to those of the South Pole—one huge glacier, the borders of which, however, did not extend into so low a latitude as that in the South Polar Regions. This is the first Expedition that has reached the boundary of the so-named Palæocrystic ice, and he believed that on all future attempts to reach the Pole the same formidable obstacle will be encountered. Captain Nares had alluded to the traces of Eskimo on the western coast of Smith Sound, and the native who was with him (Admiral Ommanney) in the Arctic Seas drew a chart, and showed that his ancestors had visited those shores and found musk-oxen there. He wished to pay his tribute of admiration to Captain Nares for the manner in which he navigated his ships, taking them as far North as there was a drop of water to be found to float them.

Captain FEILDEN said he agreed with Sir George Nares as to the paucity of animal life in those regions, and the probability that the animals which had been seen there were permanent residents. There could be little doubt that the musk-oxen seen in the northern part of Grant's Land remained there continually. There was no more reason why they should not spend the winter there than the reindeer in Spitzbergen, which was nearly as far North. The absence last year of musk-oxen at Hall's Land was probably owing to the *Polaris* crew having killed them all. Evidently at a time not very remote there must have been a much greater amount of animal life in Smith Sound than at present, because at various localities, such as Rawlings Bay and Hayes Sound, remains of large Eskimo settlements were found, having the roofs of the huts made of the skeletons of large whales and cetaceans that at one time must have penetrated Smith Sound, though during the late Expedition no trace of them was seen. Beyond Cape Union one of the sledging-parties picked up a tusk, or canine tooth, of a narwhal, which animal certainly did not come through Robeson Channel at the present date, and he also procured a rib-bone of some large whale. It was therefore probable that there had been an alteration in the climate since the Eskimo inhabited those villages which were now deserted.

The PRESIDENT: Have you any data as to the time when the Eskimo were settled there?

Captain FEILDEN said all he could safely say was that it must have been at a very ancient date, for the bone remains which had been used for sledges were often quite exfoliated from age and exposure, and there were no recent traces of any kind.

Dr. RAE, referring to Admiral Richards' statement, that if Captain Beaumont's wonderful journey were joined to that by Captain Aldrich, and extended northwards, it would almost reach the Pole, said that the total distance travelled by those two explorers in a straight line was not more than 260 geographical miles, while from the winter quarters of the *Alert* to the Pole was 460 geographical miles; a difference of 200 miles each way, or 400 altogether. Admiral Richards had also said it was not possible to travel over the ice-sea to the North; but that was only the experience of one party, and it had never been attempted elsewhere. He thought it was still quite possible that sledge-journeys might be made to the North under more favourable circumstances. All travellers who had been to the North more than once would state that they seldom found ice in the same situation in successive years, and therefore one season was not sufficient to prove the impracticability of any route. Admiral Richards had said that sledges had not been introduced for surveying purposes; but in 1846 he (Dr. Rae), with ten men, surveyed in sledges, under the auspices of the Hudson's Bay Company, at an expenditure of under 1400*l.*, his own pay included, 600 or 700 miles which had baffled three Government expeditions—one under Parry with two ships, one under Captain Lyons with one ship, and one under Sir George Back—and cost the country something like 60,000*l.* or 80,000*l.* The survey, too, was done in such a way that he would not be afraid of even the late Hydrographer to the Admiralty, Admiral Richards himself, going over the ground again. Unfortunately, he broke his chronometers; but after finding what rate per day he could travel at, he calculated the distances, and, after journeying over 300 miles, he ordered his men to build a snow-house, as he thought he was close to his point of destination, and after another hour's walk he joined his survey with that by Sir James Ross. Admiral Richards also said that if the land reported by the American Expedition had existed, the late Expedition could have got to the Pole; but surely no one was in such a fool's paradise as to suppose that that channel, Smith Sound, led right away to the Pole. The land laid down on the *Polaris'* chart was only about 70 miles north of 82° 11′, which would be upwards of 400 miles from the Pole; and if the longest journey that could be performed in sledges in a direct line was 350 miles, how could the Pole have been reached, remembering, too, that the longest journey on sledges was where animal life was abundant? In the excellent Paper which Sir George Nares read at St. James's Hall, he said that the drift on the east coast of Greenland and down Baffin Bay was at the rate of 4 miles a day; and he instanced the drift of the *Polaris* crew on the ice from the mouth of Smith Sound till they were picked up by the *Tigress*. The distance was stated in the Paper to be 740 miles in 166 days, or nearly 4 miles a day, but the actual distance measured on Petermann's chart was nearly 1600 miles, and the time occupied 201 days, giving an average of about 7¾ miles a day. All the whalers with whom he had conversed stated that the drift in summer was far greater than in the winter. Sufficient allowance had not been made by Sir George Nares for the immense friction and the destruction of the ice caused by the great rivers flowing out of Siberia and the American coast. Those rivers not only wore the ice away, but they opened large spaces of water, and the gales of wind got room to raise a sea, which broke up the ice in a manner which no person could imagine who had not seen it. Sir George Nares also said that the ice formed to a thickness of 7 feet or 7½ feet: this is true as to the open spaces, but the great floes of which the Expedition met such a quantity were not likely to increase in the same ratio. Ice 40 or 50 feet thick must sink a great deal in the water, and the lower surface must be in warmer water. If the ice was increasing at the rate that Sir George Nares supposed, we should all be in a glacial period very soon. When alluding to the open pool of water which he saw in latitude 82° in April, swarming with sea-birds, Lieutenant Payer said nothing about any strong current there, and therefore the conclusion which he (Dr. Rae) drew from that circumstance was quite different from that arrived at by Captain Nares. Wherever there was a channel of water having a very shallow place in it between two deeper parts—one on each side—even with a moderate current, the warmer under-water, in passing over the shallow part, mixed with the surface-water, and it never froze. There were such pools in all the large rivers of America. One which he had seen several times was in the St. Lawrence, close to Lachine. There was an island there, and the whole river was frozen above and below; but in a narrow channel of about 100 yards the water remained open the whole winter, the current not running more than a mile or a mile and a half an hour. The open water was very shallow compared with the parts of the river above and below. One other point he wished to refer to was the kind of sledge that should be used. Sir George Nares had said that the H. B. plan of sledging might do for light loads. He wished to assure the Society that the contention he had formerly had on this subject did not arise from any personal considerations. He simply wanted the *Alert* and *Discovery* to try his plan with their own. He also thought that snow-shoes would have been useful, and he even sent a pair on board, which proved useful before the winter was over. He had known an Indian woman haul a sledge, with 200 lbs. over and above the weight of the sledge, to the fort at Athabasca, through deep snow, with snow-shoes on.

Sir GEORGE NARES: How many days at a time?

Dr. RAE said they dragged it for weeks together, and he had hauled the same weight himself when wearing snow-shoes. The sledge he proposed could not sink in the snow, and was therefore far better than the runner-sledge. If Captain Beaumont had had flat sledges, he could probably have rounded the point of Greenland seen to the north-east, and Captain Aldrich would have gone 70 or 100 miles further with such sledges, and brought back his men not half so broken-down as they actually were. It had been said that Sir James Ross had tried the flat sledges, but those were a wretched and useless imitation, simply three or four so-called Norwegian snow-shoes tied together. The reason why the Eskimo did not use flat sledges was that they had not tough wood to make them of, and they seldom or never went upon rough ice because they never found walrus or seals there. He could not conclude his remarks without a word of praise for those gallant men who had struggled so valiantly against so many difficulties to attain the object for which they went out.

SIR HENRY RAWLINSON said, although he had had no personal experience in Arctic travelling, he had always taken the very greatest interest in the subject, and had done everything in his power to promote and stimulate Arctic discovery. He had experienced a good deal of discouragement and disappointment from the prospect, which Admiral Richards held out in the early part of his address, of their never being able to make much advance in excess of their present discoveries in the North, but in the latter part of his address he stated some facts which tended to relieve that disappointment. No doubt if any further advance was to be made, it must be in the direction of Spitzbergen; but there were some indications that land assistance might be obtained even there. At the very farthest point reached by Payer he saw land in the extreme distance, trending away towards the Pole, and it was far from improbable—at any rate, the contrary had not been proved—that there might be a range of land stretching away from Franz Josef Land in the direction of the Pole, which might enable sledge travelling to be resorted to. They therefore had two strings to their bow; first, the chance of sea navigation, and next the chance of sledge travelling, and he was therefore very loth to give up the prospect of advancing further North without more examination. He wished also to impress upon the Meeting what he thought had never yet had sufficient importance attached to it, namely, the actual extent and value of Sir George Nares' *bonâ fide* geographical discoveries. Reaching the Pole, supposing it to be ice or sea, would have led to no geographical result whatever, the map would not have been changed one iota; but 25° of longitude in one direction, and between 10° and 15° in another, had now been explored. From the top of Kennedy Channel Captain Aldrich towards the west and Captain Beaumont towards the east had discovered and laid down a long line of coast, but there was still a wide field for discovery in that direction. What must yet be done was the complete delineation of the outlines of Greenland, connecting Beaumont's furthest with Parry's furthest on the east side. Until that was done, geographers would not be satisfied. Whether it was accomplished by the Swedes, the Americans, or the English, was really of no great importance, but science required that the whole of Greenland should be, if not circumnavigated, circumsledged. The Geographical Society fully appreciated the results of the late Expedition, and he was sure the Fellows would be delighted if the Council determined to award their highest honour to Sir George Nares, as he had already been honoured by Her Majesty, the Fountain of Honour.

SIR ALEXANDER MILNE said he held a position at the Admiralty when the late Expedition was fitted out, and indeed when every expedition since 1847 had been despatched, and he was pretty well versed in what had been going on. The object of the Expedition no doubt was, if practicable, to reach the North Pole. From the discoveries of Hall it was supposed that the land beyond the point reached by the *Polaris* trended northward; but Sir George Nares had found it trended to the west on the coast of America, and to the east on the coast of Greenland, and that it was impracticable to pass over the great Frozen Sea, which stretched beyond the point at which the *Alert* wintered. The sledge-party under Captain Markham could only carry seventy days' provision, thirty-five of which was for the return journey, and must have been sensible that they were on a forlorn hope. It was not expected that when Sir George Nares arrived at his northernmost point he would have to send travelling parties east and west, and so reduce the strength of the Expedition. From all he had read and heard, he believed it was perfectly impossible for the Expedition to have done more than they had done; and when the autumn arrived, what was the use of their again wintering in the ice? They would only go over the same ground; and Sir George Nares exercised a wise discretion in returning to England, and had added largely to the geographical knowledge of the northern part of America and Greenland.

Sir GEORGE NARES, in reply, said the only remarks he felt it necessary to make were in answer to those by Dr. Rae, whom all Arctic travellers looked upon as being about the best critic they could possibly have. Perfectly honest criticism always did good, and from such a successful traveller as Dr. Rae, the more criticisms the better. But it should not be forgotten that even Dr. Rae himself had not done any greater distance in the matter of sledge-journeying than naval parties had done. With regard to the drift, it was only a matter of 2 or 3 miles a day, and what he had said he must stick to. On a former occasion, he mentioned that the rivers of Siberia and other parts did break up the ice in the Polar area, and that the ice first melted away at the mouths of those rivers, so that Dr. Rae and himself were at one with regard to that point. He could not now enter upon the question of the temperature of the water. It was still a moot question what was the temperature inside a glacier. All he had stated was that he had seen ice 100 feet thick, and had noticed water running underneath a glacier long after that water might have been expected to have been frozen. On board of the *Challenger* he used to tell Sir Wyville Thomson, that water under the great glaciers in the Alps could not be below 32°, but he had since found that it could, although he had never met with any explanation of it. He would not enter upon the question of the kind of sledges to be used, but even Dr. Rae, on one occasion came to very rough ice, and had to leave his flat sledges behind, and carry the weights on the backs of his men.

Dr. RAE said the sledges he had on that occasion were not flat but high runner-sledges, such as were used by the late Expedition, which he took good care never to use again.

The PRESIDENT, in conclusion, observed that the discussion had been most interesting and instructive. Although, according to Sir Alexander Milne, the Admiralty contemplated that Sir George Nares could reach the North Pole, the Royal Geographical Society simply desired that the vast Polar area, 1,000,000 or 1,300,000 miles, should be explored as far as possible, and the Expedition had explored a very considerable part of it, doing all that the gallantry and courage of men could accomplish.

Tenth Meeting, *23rd April*, 1877.

SIR RUTHERFORD ALCOCK, K.C.B., PRESIDENT, in the Chair.

PRESENTATIONS.—*A. C. De Crespigny, Esq.; John Lobb, Esq.; James B. Scott, Esq.*

ELECTIONS.—*Captain Edward S. Adeane*, R.N.; *Ernest Giles, Esq.; Henry Goodliffe, Esq.; Pringle Hughes, Esq.; William Isbister, Esq.; Adolphus F. Janvrin, Esq.; Archibald Liversidge. Esq.; Baron Frederic von Otter; C. E. Pitman, Esq.; Captain P. A. Scott*, R.N.; *John Joseph Shillinglaw, Esq.; George Goldie Taubman, Esq.: Captain H. G. Webb* (36th Regiment).

DONATIONS TO THE LIBRARY, MARCH 26TH TO APRIL 23RD, 1877.—The Cradle of the Blue Nile, by E. A. de Cosson (*Author*). A short relation of the River Nile, 1791, reprint (*C. R. Markham, Esq.*). L'Afrique centrale: étude sur ses produits commerciaux, par R. J. Bernardin (*Author*). Narrative of the discovery of the great central lakes of Africa, by J. L. Clifford Smith (*Author*). Jòn Jònsonn's Saga, by G. R. Fitzroy Cole (*Author*). Procès-verbal de la 16me. séance de la Commission Géodesique Suisse, Neuchatel (*Dr. J. M. Ziegler*). A short essay on the Brochs, &c., of the Orkney Islands and North of Scotland, by J. Fergusson (*Author*). Abstract of the Reports of Surveys, &c., in India for 1874–75 (*H.M. Secretary of State for India*). Records of the Geological Survey of India, X., pt. 1 (*The Survey, per W. R. Bion, Esq.*). Annales Hydrographiques, Nos. 559 and 562, and Nos. 558, 560, and 561 of other publications of the French Marine Department (*The Department*). Anuario Hidrografico de la Marina de Chile, iii., 1877 (*J. Vidal Gormaz, Director of the Chilian Hydrographic Office*). The book of Physical Geography, by Keith Johnston (*Author*). Vols. xix.–xxiii. of the Bulletin, xxxv.–xxxviii. of the Mémoires, and xxxiii.–xxxvi. of the Mémoires couronnés, of the Royal Academy of Sciences of Belgium (*The Academy, towards completion of series*). And the current issue of publications of corresponding Societies, &c.

DONATIONS TO MAP-ROOM FROM 26TH MARCH TO 23RD APRIL, 1877.—21 sheets of Admiralty Charts (*Hydrographic Office*). 20 sheets of French Charts (*Dépôt de la Marine*). 102 sheets of the Government Surveys of India, and Map of Baluchistan, &c., 1876 (*H.M. Secretary of State for India, through the India Office*). Hypsometric map of the United States, and Drainage map of Colorado; U.S. Geological and Geographical Survey of the Territories, 1877

(*Dr. F. V. Hayden, Esq.*). 3 maps and illustrations from Petermann's 'Geographische Mittheilungen,' 1877 (*Dr. A. Petermann*).

The following Lecture was then delivered by the Author:—

On the Temperature of the Deep-Sea Bottom, and the Conditions by which it is determined. By Dr. CARPENTER, M.D., LL.D., F.R.S.

INTRODUCTION.

THE distribution of Temperature on the Oceanic Sea-bed is a subject which, when pursued through the whole range of its relations, will be found not inferior in scientific interest and importance to any other department of Terrestrial Physics. A mere indication of the more prominent of these relations will serve to show you their magnitude and extent; and will thus, I hope, enlist your attention to the exposition I have to offer of our present knowledge in regard to it.

In the first place, we are dealing with one of the most important of the Physical conditions of at least *two-thirds of the surface of the solid crust of the Globe*, constituting the bottom of the great Ocean-basins; as to the Thermal state of which it was known more than a century ago, that the surface-temperature of the water which fills those basins, gives us no indication whatever. But although the inquiry has been prosecuted from time to time by Navigators so distinguished as Cook, Phipps, Péron, Krusenstern, Scoresby, Kotzebue, Beechey, John Ross, Parry, Franklin, D'Urville, Du Petit-Thouars, James Ross, Fitzroy, and Belcher, and by Physicists of such ability as Hales, Saussure, Horner, Sabine, Lenz, Humboldt, Martins, Aimé, Biot, Pouillet, Arago, and Herschel, the imperfection of the methods generally employed has not merely led to a discordance in their results, which long left it in doubt which of them were the most worthy of credit, but has had the yet worse effect of causing statements which we now know to be altogether erroneous, to be widely accepted as scientific generalizations, on account of the high authority on which they were promulgated.

It is not, I think, going too far to say, that the systematic prosecution of this enquiry during the last nine years, beginning with the Cruise of the 'Lightning' in the summer of 1868, continued in the 'Porcupine' Expeditions of 1869 and 1870, and in the 'Shearwater' in 1871, constituting one of the special objects of the 'Challenger' Circumnavigation Expedition of 1872–6, carried into the northern part of the Pacific by the U.S. Frigate 'Tuscarora,' and lastly extended into the North Polar area by our Arctic

Expedition,—has now cleared up most of its obscurities; not only giving to the Physicist, for the first time, a solid basis of fact on which he may securely rest his reasonings, but also unmistakeably indicating the direction in which he is to seek for the *rationale* of the remarkable state of things now presented to his consideration. In following out this clue, he finds himself brought into contact with problems of the most recondite nature in regard to the properties of Water as a Fluid, which are at present occupying the minds of Mathematicians and Engineers of the highest eminence; and I think I shall be able to show you that the evidence afforded by the Thermometer of *vast movements of translation* of Polar water over the whole Oceanic Sea-bed, not only as far as the Equator, but 50° beyond it, and attributable to no other agency than the diversities in Specific Gravity occasioned chiefly by diversities in Temperature, is likely to afford data of great value as to the solution of those problems. No more need be said, then, of the interest and importance of this subject in relation to Physics.

The Biological condition of the Deep Sea is so intimately related to the Temperature of the bottom, as obviously to be determined by that condition in a much greater degree than by its depth. This was very strongly impressed on Sir Wyville Thomson and myself in our early investigations. For in the deep trough lying N.E. and S.W. between Shetland and the Faroe Islands, which, as having been our cruising-ground in 1868, I have ventured to call the 'Lightning Channel,' we found at corresponding depths of between 500 and 600 fathoms, and sometimes within a few miles of each other, two Areas whose temperatures differed by more than 13° Fahr.; the bottom-temperature of the 'warm area' being about 43°, whilst that of the 'cold area' was somewhat below 30°. The Faunæ of these two areas showed the most marked diversities. For while the Sea-bed of the 'warm area' was covered with Globigerina-ooze, on the surface of which were multitudes of Siliceous Sponges belonging to the Hexactinellid type, the 'cold area' had a bottom of sand and gravel, and the most conspicuous feature of its Fauna consisted in the number and variety of its Boreal types of Echinodermata. We subsequently found that many species of Mollusca, Crustacea, and Echinodermata supposed to be purely Arctic, range southwards in the cold water of great Atlantic depths, as far south as the entrance of the Mediterranean. And I was thus led in my Report for 1869 to express my entire concurrence in the speculation thrown out some years previously by Professor Lovén, that "there exists in the "great Atlantic depression, perhaps in all the abysses of our globe, "and continued from Pole to Pole, a Fauna of the same general "character, thriving under severe conditions, and approaching the "surface where none but such exists,—in the coldest seas."* This expectation has been most remarkably confirmed by the 'Challenger' researches; one of the most important of the general results of that Expedition being the recognition of an abyssal Fauna essentially the same over the whole Oceanic area that is reached by the glacial underflow, without any relation whatever to the Terrestrial climate of the locality, and scarcely showing any difference according to its Arctic or Antarctic derivation. Thus we see that, even at the present time, the essential conditions of a 'glacial epoch' prevail upon the Deep-Sea-bed from each Pole to the Equator; so that the presence of Arctic types of animal life in any *marine* deposit of Temperate or even Tropical zones, affords not the least evidence, *per se*, of the former extension of Glacial action over the *land* of those localities.

By this we see how important is the study of Deep-sea Temperature to the Geologist. For it affords him the means of resolving many difficulties, and avoiding many errors, into which, without such knowledge, he would almost inevitably fall. Thus, as I pointed out in my very first Report,† if the area of the 'Lightning Channel' were to be raised into dry land, so that the deposit at present in progress on its bottom should become the subject of examination by some Geologist of the future, he would find one part of this to consist of a Sandstone, including fragments of older rocks, the imbedded Fauna of which would present a distinctly Boreal character; whilst in *stratigraphical continuity* with this he would find a Chalk-like deposit, including an extraordinary abundance of Sponges bearing a strong resemblance to Ventriculites, with other animal remains indicative of derivation from a submarine climate probably even warmer than that in which they present themselves. But again, in the middle of our 'cold area' we found a bank rising some 300 fathoms from the bottom, so that its surface lay in the comparatively warm upper stratum; and here the characteristically Boreal Fauna was replaced by one of much more Temperate *facies*. Now if this bank were to share in the upheaval just spoken of, the future Geologist would find a hill some 1800 feet high, covered with a sandstone continuous with that of the land from which it rises, but rich in remains of Animals that are not found on the lower plane; and might easily fall into the mistake of supposing that two such different Faunæ, occurring at different levels, must indicate two dissimilar climates separated in Time, instead of depending upon the differences of Temperature that present themselves between two parts of a continuous bottom, according as its elevation or depression causes it to lie in a warmer or a colder stratum of the water of the Channel.

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* 'Proceedings of the Royal Society,' Nov. 18, 1869, p. 475.—The similarity of Antarctic to Arctic forms of Marine life had, indeed, been previously noticed by Sir James Ross; and had been attributed by him to the prevalence of a 'similar temperature' over the whole intervening Sea-bed. This temperature, however, he erroneously supposed to be 39°·5 Fahr.

† 'Proceedings of the Royal Society,' Dec. 17, 1868, p. 193.

Another very important Geological consideration is the frequent dependence of Bottom-Temperature upon the contour of the solid floor and walls of the basin at great distances, and the consequent liability of the Submarine Climate of any locality to be completely changed by elevations or depressions of parts of the Earth's crust thousands of miles off. Thus, to take a very simple and obvious case, the thermal condition of the whole of the Western basin of the Mediterranean below 100 fathoms would be altogether reversed by such a sinking of the bottom of the Strait of Gibraltar, as would open a communication between the abyssal portions of the Mediterranean and the Atlantic basins. For the place of water of a uniform temperature of 55° down to the greatest depths, by which the Western basin of the Mediterranean is now occupied, would then be taken by a succession of layers of Atlantic water becoming progressively colder with depth, bringing down the temperature of the Sea-bed from 55° to 36°·5 Fahr. But this would not affect the Eastern basin, unless there were a like sinking of the comparatively shallow sea-bed between Sicily and the African coast, which would give further passage to the flow of glacial water into the abyssal depths that intervene between Malta and the Levant, now occupied by water of 56° Fahr.;—the glacial underflow thus extending itself to a distance of more than 2000 miles from its entrance into this great Inland Sea, which is itself removed by 3000 miles more from its Polar source.

If, again, in some former period of the Earth's history, the disposition of Land and Sea was so different from that which now prevails, that either the Polar areas were occupied by land, extending (say) to the 55th parallel, or that both Polar basins were completely enclosed by land, as the Arctic basin now is round three-fourths of its border;—the thermal condition of the Ocean which would then occupy the greater part of the Intertropical zone, would resemble that of the Mediterranean in the absence of any glacial under-stratum; and the comparative warmth of its Sea-bed would enable it to support a Fauna of a very different kind from that which it bears at present.—Hence it is obvious that no conclusions can be correctly drawn from the distribution of Marine Animal Life in former Geological periods, without a knowledge, not only of the existing distribution of Temperature on the Deep-Sea-bed, but also of the conditions on which each distribution depends; so that the Thermal effects of variations in those conditions may be duly appreciated.

The enquiry on which we are engaged has also a *practical* bearing of such great and increasing importance, that I must not leave it unnoticed in this introductory sketch;—I refer to Submarine Telegraphy. The Temperature of the bottom on which a Telegraph Cable is laid, is an important element in its successful working;—*first*, as modifying the conducting power of the wire; and *second*, by affecting the completeness of the insulation. The conducting power of the wire is so greatly affected by its Thermal condition—being augmented by cold, and diminished by heat—that a wire whose diameter is sufficient to enable it to convey messages across the Atlantic, where it lies on a bottom of about 36°, might be quite inadequate to convey the same messages across or along the Mediterranean, where it lies, even at the greatest depths, on a bottom 20° warmer. And a wire that should work effectively in the Mediterranean, might be quite ineffective in the Red Sea, on a bottom still warmer by 15°. It is obviously essential, therefore, that before constructing a Telegraph-cable for any Marine locality, the Thermal condition of its bottom, no less than its general character, should be carefully determined. This precaution is especially necessary where a cable is to lie along a shallow bottom in the Intertropical Zone, such as that of the Strait of Malacca; for such a bottom is subject to be unusually heated by the 'downward convection' I shall hereafter describe. And the neglect of this precaution has been the occasion, as I have learned on the best authority, of very serious losses. The same principle applies to the insulation of the wire, which is much more easily maintained at a low than at an elevated temperature; so that special precautions are required in such cases as that to which I have just referred.

TEMPERATURE OF THE DEEP-SEA-BOTTOM.

Historical Sketch.—The doctrine current in this country in regard to Deep-Sea Temperatures, at the time when the subject was taken up by Sir Wyville Thomson and myself in 1868, was that which had been expressed by Sir John Herschel not many years previously in the following terms:—"In very deep water all over the globe, a "uniform temperature of 39° Fahr. is found to prevail; while above "the level at which that temperature is first reached, the ocean may "be considered as divided into three great regions or zones—an "Equatorial, and two Polar. In the former of these, warmer, in "the latter, colder, water is found at the surface. The lines of "demarcation are, of course, the two isotherms of 39° mean annual "temperature."* This doctrine seems to have been first promulgated by D'Urville, as the result of the thermometric observations made by him during the Voyage of the 'Astrolabe' (1826–29); which observations, whose correctness had been called in question by Lenz and other Physicists, seemed to be confirmed by those made during Sir James Ross's Antarctic Expedition (1839–1843). It is clear that in interpreting their observations, both D'Urville and Ross were misled by their belief that Sea-water, like fresh water, attains its greatest density between 39° and 40° Fahr.: expanding, instead of contracting, as it is further cooled. The latter explicitly says;—"The experiments which our limited "time and means admitted of our making, serve to show that the "mean temperature of the ocean at present is about 39°·5 Fahr., "or 7½ degrees above the freezing-point of pure water, and as "nearly as possible the point of its greatest density," and it even seems as if he considered that this point would be most exactly determined by exact thermometric observations in Deep Seas; "as we "now know where we may send any number of thermometers down "to the greatest fathomable depths without an alteration of tem"perature, even to one-tenth of a degree."† Yet as far back as 1819, Dr. Marcet had ascertained "that the law of greatest specific "density at 40° does not apply to sea-water, but that, on the con"trary, sea-water gradually increases in weight down to its freezing-"point, until it actually congeals." And he determined the ordinary freezing-point of sea-water to be about 28°; although, when in large vessels, and kept perfectly still, he found that it could be cooled down many degrees below this without freezing.‡

Since the fallacy of the doctrine of D'Urville and Ross has been conclusively demonstrated by the researches of the last nine years, the older observations in which Deep-Sea Temperatures lower than 39° were obtained, and of which an admirable collation and discussion has been recently published by Prof. Prestwich,§ have received their merited appreciation. Among the best of these should be ranked the observations systematically made under the direction of Lenz (by an ingenious but laborious method which he specially devised to avoid the error occasioned by the pressure of waters on the bulbs of Thermometers let down into the Deep Sea) during Kotzebue's Second Voyage (1823–26), and those of Du Petit-Thouars in the Voyage of the 'Venus' (1836–39). And several observations taken by Arctic navigators, which gave bottom-temperatures of 32° Fahr., or even lower, and which were supposed (under the prevalence of the D'Urville and Ross doctrine) to be exceptional, if not erroneous, are now established as both correct and normal.

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* 'Physical Geography,' 1861, p. 45.

† Ross's 'Voyage to the Antarctic Regions,' vol. ii. p. 375.

‡ "On the Specific Gravity and Temperature of Sea-water," in 'Philos. Transact., 1819, p. 161.

§ 'Philosophical Transactions,' 1875, p. 587

The explanation of the whole series of discrepancies lies in this,—that while the readings of the Thermometers used by D'Urville and Ross were doubtless correctly taken, the instruments themselves were deranged by the tremendous pressure they encountered when lowered down to great depths in the sea; this pressure being, in round numbers, *one ton on every square inch* for 800 fathoms of depth, or *three tons on the square inch* for what now proves to be rather within than beyond the average depth of the great Oceanic Basins. This pressure, acting on the bulb of the ordinary self-registering Thermometer, produces a compression which forces up a part of its contents into the tube, and thus causes it to register, as the actual *minimum* temperature obtained at great depths, what is really several degrees *above* it. And thus an 'unprotected' Thermometer which shows a temperature between 39° and 40° at (say) 400 fathoms from the surface, still records the same temperature when let down to 750, 1000, 1500, 2000 fathoms, or more, passing through a succession of strata whose real temperature diminishes from 39° to 32°; the progressive reduction in the bulk of the liquid in the bulb, which should have caused the lowering of the index in the tube, being antagonized by the progressively increasing pressure on the bulb, which, diminishing its capacity, forces up its contents into the tube, and thus maintains the index at the same elevation.

The elimination of this source of error,—by the enclosure of the bulb of the Deep-Sea Thermometer in an outer bulb sealed round its neck, the intervening space being partly filled with liquid, but about one-fourth of it being left void, so that the effect of pressure in diminishing the capacity of the outer bulb is not communicated to the inner,—was first devised by Admiral Fitzroy, whose method was worked out twenty years ago by Messrs. Negretti and Zambra; and thermometers thus 'protected' were supplied to Captain Pullen, who made with them an important series of observations in the Atlantic and the Indian Ocean, which confirmed those of the previous observers who had maintained the existence in those seas of an abyssal temperature as low as 35°. His observations, however, were only in part made public, and attracted but little notice,—having obviously been quite unknown to Sir John Herschel; and Admiral Fitzroy's method of 'protection' seems to have been forgotten, save by the Makers who had carried it out. For when the remarkable results which were obtained in the short Cruise of the 'Lightning' in 1868 (p. 290), led me to enquire into the effect of water-pressure on Deep-Sea Thermometers, I could not learn that anything was known as to the amount of error it might introduce, or that any means had been taken to prevent it. A set of experiments was then made by Mr. Casella, at the instance of the Hydrographer to the Admiralty, by which it was demonstrated that a water-pressure of three tons on the square inch caused a rise of from 7° to 10° in the best Thermometers of the ordinary construction: and in order to prevent this, the late Prof. W. A. Miller devised a method of protection identical in principle with that of Admiral Fitzroy, which was most successfully carried out by Mr. Casella.* In all the observations since made under the direction of the British Admiralty, as in those of the U.S. Frigate 'Tuscarora,' Six's *maximum* and *minimum* thermometers thus 'protected,' and severely tested by hydrostatic pressure, have been employed with the most satisfactory results; and it may be stated with confidence that by their means, under all ordinary circumstances, the Temperature either of the sea-bottom or of any stratum above it may now be determined with certainty within *half a degree* (Fahr.). When, however, such extreme depths are sounded as the 4475 fathoms once obtained by the 'Challenger,' it is not surprising that a pressure of *five and a half tons* on the square inch should break the bulbs of thermometers which had previously resisted a pressure of more than *four*. And when, as in summer visits to Polar waters, the Temperature of the *surface*-stratum is reduced to 30° or under by the melting of floating ice, while its Specific Gravity is at the same time lowered by the reduction of its salinity (so that the water thus chilled does not sink), the temperature of the bottom, or of any intermediate stratum, cannot be satisfactorily determined by the *minimum* thermometer; and recourse must be had to the ingeniously-contrived Thermometer of Messrs. Negretti and Zambra, which records the temperature either of the bottom, or of any stratum to which it may be lowered, by a reversal of its position, effected at the moment when an upward movement is given to it by the suspending line.*

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* See 'Proceedings of the Royal Society' for Nov. 18, 1869, p. 409.

General Results.—By the use of these instruments, a vast body of trustworthy information has now been accumulated, in regard not only to the Temperature of the Deep-Sea-bottom, but also to what may be called the Thermal Stratification of the contents of that great Ocean-basin, whose continuity (as Sir John Herschel remarked) is one of the most noteworthy features of the present configuration of our Globe. And it may now be confidently stated as a general fact (1) that over not only the Temperate but also the Intertropical portions of the Oceanic area, a bottom-temperature prevails of between 32° and 35°·5 Fahr., whilst within the Polar areas this temperature falls to 28°. Further, it may be asserted (2) that this vast Oceanic basin, whose average depth may be estimated at about *two miles and a half*, is occupied to within 400 fathoms of its surface (save in the exceptional case of the North Atlantic, p. 310), by water whose temperature is below 40° Fahr.,—this cold water actually coming up nearer to the surface in the Equatorial Atlantic (as several of the older observers had noticed) than it does beneath the Tropics.

The case is quite different, however, in regard to the *Mediterranean;* which, although ranking as an Inland Sea, has almost the vastness and depth of an Oceanic basin. For below the superficial stratum of from 100 to 200 fathoms' depth, whose temperature varies with the season, a uniform temperature of from 54° to 56° (according to the locality) is found to prevail, even down to the abyssal depth of 2000 fathoms,—thus conclusively proving that depth *per se* is not one of the conditions on which depends the Deep-Sea Temperature of 35°·5, which prevails in the Atlantic under the same parallels. So in the *Red Sea*, the whole mass of water beneath the variable surface-stratum shows a uniform temperature of 71°. And even within the great Oceanic area, there are several minor basins whose Thermal condition presents similar peculiarities. So far, however, from being in any degree anomalous, these exceptional cases will be found to harmonize so completely with the general principle to which we shall find the ordinary phenomena of Ocean Temperature to be referrible, as to afford it the most satisfactory confirmation it could well receive; and I shall make advantageous use of them in the enquiry through which I shall now conduct you, as affording the means of discriminating with certainty between the *local* and the *remote* conditions on which the Temperature of the Sea-bottom depends. Nothing more is needed, as it seems to me, for the solution of the problem, than what may be called the 'common sense' application * of those great general principles of Fluid Pressure, with which every tyro in Physical Science is verbally familiar, but of which the bearing seems to me to have been completely misapprehended by some who claim to write with authority on the subject.

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* 'Proceedings of the Royal Society' for March 12, 1874, p. 239.

RELATION OF THE TEMPERATURE OF THE DEEP-SEA TO THAT OF THE SURFACE.

There can be no reasonable doubt that the Temperature of the entire mass of Oceanic water is essentially dependent, either directly or indirectly, upon that of its *surface;* the latter being determined either by Solar radiation, or by the temperature of the superincumbent Atmosphere, or by both combined. For although it might be naturally supposed that the Thermal condition of the solid Crust of the Earth which forms the bottom of the Ocean-basin, would affect that of the Water it contains, yet we know from other sources that any such influence must be rendered nugatory—as compared with that of other agencies—by the very slow conducting power of that crust. The observations which have been made upon thermometers sunk at different depths in the soil of Central Europe, have shown that the *diurnal* variations of its surface-temperature are no longer perceptible at a depth of *three* feet; and that even the extremest *annual* variations are scarcely traceable at a depth of *thirty* feet And it is well known that corn ripens on the plains of Siberia, with a frozen soil at the depth of a very few feet beneath it. The temperature of the Sea-bed, therefore, will rather be determined by that of the water which overlies it, than will the temperature of the water by that of the bottom on which it rests.† And we have therefore to look at the Temperature of the Earth's crust as a condition whose slowness of operation places it in the class of *secular* agencies; only slightly—if at all perceptibly—modifying the operation of those which obviously exert the greatest potency.

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* See the letter of Sir John Herschel in the 'Proceedings of the Royal Geographical Society,' vol. xv. p. 211.

† In my first visit to the Mediterranean in 1870, I was struck with the close correspondence between the uniform temperature of the mass of Mediterranean water, and that of the Crust of the Earth in Southern Europe; and was disposed to regard the former as essentially determined by the latter (see my 'Report' for that year in the 'Proceedings of the Royal Society,' Dec. 8, 1870, p. 196). I am now satisfied, however, for the reasons to be hereafter stated, that this correspondence is merely accidental, and that the uniform temperature is essentially determined by *surface*-influences.

We shall in the first place, then, consider generally the relative effects of Heat and Cold applied to the *surface* of large collections of water; as, in the case of *fresh* water, to that of a deep Lake, and, in the case of *salt* water, to that of an Inland Sea. If, in so doing, I should seem to dwell with needless minuteness upon facts with which every well-informed person is familiar, I would ask you to believe that I do so only because convinced by experience of the importance of definitely fixing every point as we go along, and also because the differences in the behaviour of *fresh* and *salt* water under the same Thermal conditions, make it requisite in the study of the latter that the former should be rightly apprehended.

Action of Surface-Cold and Surface-Heat on a Fresh-water Lake.—When the surface of a Lake is exposed (as by a change of wind) to an Atmospheric temperature much lower than its own, the superficial film of water loses its heat by radiation; and as this is not restored by conduction from beneath,* the augmentation of its Specific Gravity produced by the reduction of its bulk causes it to sink until it meets with water as cold as itself, its place being taken by warmer water coming up from below. This fresh film, subjected to the same surface-cold, sinks in its turn; and so long as there is water beneath that is warmer than the water of the surface, this *downward convection of Cold* continues, until the temperature of the entire mass, down to its very bottom, has been reduced to 39°·2 Fahr., the temperature at which fresh water is reduced to its smallest bulk and possesses its greatest Specific Gravity. But as any further reduction in the temperature of the superficial film causes it to expand, instead of contracting, it is thus rendered specifically lighter, instead of heavier, than the subjacent water; and being thus kept at the surface, it is further cooled until it freezes, while the stoppage of the downward convection leaves the whole mass beneath at the temperature of 39°·2.

When, on the other hand, the surface-water of a Lake is subjected either to direct Solar radiation, or to the contact of an atmosphere warmer than itself, the film whose temperature is thus raised will expand; and thus, becoming specifically lighter, will tend to remain *at* the surface, *no downward convection of Heat* (at temperatures above 39°·2) being possible in fresh water.—The limit to the downward action of Surface-Heat, therefore, in the case of *fresh* water, will be that of the direct penetration of the Solar rays; below which the water that has been once cooled-down can nly be warmed again by *conduction* either from above or from below,—a process so slow that it has no perceptible effect in modifying *seasonal* variation. And hence the Heat that acts on the surface of *fresh* water is mainly expended (so to speak) in producing evaporation, and is thus dispersed whithersoever that vapour may be transported; while the Cold similarly applied may be said to pass into the water itself, on which it consequently exerts a *cooling* effect that is far greater than the *warming* effect produced by an equivalent amount of Surface-Heat. That cooling effect, however, is limited, as regards deep water, to 39°·2 Fahr.

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* The conducting power of Water is so small that we may practically disregard it, except in questions of 'secular' adjustment of Thermal Equilibrium.

Thermal Condition of the Swiss Lakes.—We have an admirable exemplification of this principle, in the Thermal condition of the deep Lakes of Switzerland; which has been recently determined by a careful series of observations made in connection with the study of their Biological conditions.* The entire basin of each lake may be considered as lying under the same range of Atmospheric temperature, and as subjected to the same Solar radiation. The temperature of the surface varies, of course, with the diurnal and seasonal variations of atmospheric temperature; but the effect of the former soon becomes imperceptible as it is traced downwards; and that of the latter entirely ceases at a depth of between 25 and 30 *mètres*,—or, in round numbers, between 80 and 100 feet. Below that depth, and down to the very bottom of each Lake,† a *uniform* and *constant* Temperature is met with, the variation not amounting to 0°·1 Cent.; so that, as Dr. Forel remarks, "les grands profondeurs "des lacs d'eau douce sont probablement le milieu le plus invariable "au point de vue de la température où les animaux soient appelés "à vivre sur notre terre." This constant temperature differs in different Lakes, being 5°, 6°, 7°, or 8° Cent. (= 41°, 42°·8, 44°·6, 46°·4, Fahr.), according to their locality. It is clear, therefore, that as neither diurnal nor seasonal variations show themselves beneath a stratum of 100 feet in thickness, this must be the extreme limit of the direct heating power of the Sun. And thus, to whatever point the downward convection of Cold during the winter reduces the temperature of the whole of the deeper stratum of any such Lake, that temperature will be retained by it with scarcely any variation from one year to another. Whether this constant temperature represents the mean winter Air-temperature of the locality, must

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profonde du Lac Léman," in Acta Soc. Helv. des Sci. Nat., 1873.

† The Lake of Constance has a maximum depth of 964 feet, and the Lake of Geneva of about 1000; the bottoms of both being above the level of the sea. On the other hand, the greatest depth of the Lake of Como is 1981 feet, of which two-thirds lie beneath the sea-level; and the greatest depth of the Lago Maggiore is 2800 feet, of which more than three-fourths lie beneath the sea-level.

be determined by further observation. It has been found to do so very closely in the case of Loch Lomond; the bottom-temperature of which, and the mean winter air-temperature of the locality, are both 41°. But there are several conceivable conditions which may prevent this accordance from being precise; such, for example, as relative differences in the effect of Solar radiation on the Atmosphere and on Water, and the modifications produced in the former by Hygrometric conditions.

Action of Surface-Cold and Surface-Heat on an Inland Sea.—The action of Cold applied to the surface of a body of *salt* water, is affected in a very important way by a property which notably distinguishes it from *fresh* water,—that of contracting, and therefore increasing in Specific Gravity, *down to its freezing-point;* so that whilst fresh water is no heavier when just about to freeze than it is at about 46°, sea-water is at its heaviest when just about to freeze; and whilst its solidification ordinarily takes place at 28° Fahr., it may be cooled down, by being kept very still, as low as 25° (or even, according to Dr. Marcet, as low as 22° Fahr.) with a still further increase of density. Hence it is an invariable rule for Sea-water (its salinity being taken as constant), that *the colder it is, the heavier it is.* And from this it will obviously result that, supposing the water of an Inland Sea to be subjected to Atmospheric Cold, its surface-cooled films will continue to sink, one after another, and to be replaced by warmer water coming up from below, until the whole mass of its water shall have been brought down to near 28° Fahr.;—no ice being formed on its surface until that reduction shall have been completed. And thus severe Cold continuously applied to the surface of a body of Salt water, passes down to its greatest depths, reducing the temperature of the entire mass more than 10° (Fahr.) below what is possible in a deep basin of Fresh water.

The effect of Heat also, applied to the surface of Sea-water, is modified by its Salinity. For the increased evaporation which takes place from the superficial film, by concentrating its salt, renders that film specifically heavier than the subjacent water, notwithstanding its higher temperature; and it consequently descends through the less saline but colder subjacent water, which rises up to replace it. Thus a *downward convection of Heat,* though impossible in *fresh* water, is a necessary consequence of the action, either of Solar radiation, or of hot dry Winds (which still more strongly promote evaporation), on the surface of *salt* water; and we shall presently see that this is an agency of great importance.

Thermal Condition of the Mediterranean.—There is no Inland Sea whose Thermal condition has been so carefully studied as that of the Mediterranean; and we shall find the study of it peculiarly instructive. Its bottom-temperature was first examined by Saussure in 1780 by two soundings taken in the Gulf of Genoa, one at 158 and another at 320 fathoms; and notwithstanding the imperfection of his method, the results he procured,—55°·5 Fahr. at both depths,—closely accord with those subsequently obtained with trustworthy instruments. In 1826, D'Urville, when starting on the circumnavigation voyage of the 'Astrolabe,' determined by serial soundings between Toulon and Gibraltar, that the Temperature of the Mediterranean decreases from the surface downwards to about 180 fathoms, below which he found it constant at between 54° and 55° Fahr. to a depth of more than 500 fathoms; and the same temperature was found by Bérard in 1831 to extend to a depth of more than 1000 fathoms. These results were confirmed by those obtained in 1840–44 by Aimé; who carried on a series of observations through several seasons between Marseilles and Algiers; not extending them, however, to any great depths. He found that the *diurnal* variations of temperature are confined to a thin superficial stratum of less than 10 fathoms; and that the *seasonal* variations cannot be traced below 200 fathoms; beneath which depth the temperature is *uniform* and *constant.* No observations seem to have been taken before 1871 in the Eastern basin of the Mediterranean, save those of Admiral Spratt; who confirmed Aimé's conclusions as to the constant and uniform temperature prevailing at all depths below 300 fathoms, but was led by the error of his Thermometers to estimate that constant Temperature at about 59°, which is 2°·5 too high. In the summer of 1870, I made a series of careful Temperature-soundings with 'protected' Thermometers in the Western basin of the Mediterranean, at several points between Gibraltar and Malta; and in the summer of 1871, I extended these observations into the Eastern basin between Malta and Alexandria. By combining my own results* with those of Aimé, I shall be able, I think, to give you a very exact account of the Temperature phenomena of this vast basin, almost Oceanic in its extent and depth.

The marked contrast shown by D'Urville's Temperature-soundings, between the Thermal condition of the Mediterranean and that of the Atlantic under the same parallels, was rightly attributed by Arago to what we now know to be indubitably its true cause,—the seclusion of the Mediterranean basin from that underflow of Polar water by which the temperature of the abyssal depths of the Atlantic is kept down. For the Strait of Gibraltar, which has a depth of about 500 fathoms between Gibraltar and Ceuta, gradually shallows as it widens towards its western *embouchure* between Capes Trafalgar and Spartel; where there is a ridge or 'submarine watershed,' of which the general depth is about 120 fathoms, only certain passages across it approaching 200 fathoms in depth. This ridge, as shown in Diagram I., interposes an effectual barrier to the entrance of all Atlantic water *below* about 54° Fahr.; while it admits a large influx of its upper stratum *above* that temperature, drawn in by the excess of evaporation from the general surface of the Mediterranean over the whole amount returned to its basin by rain and rivers. Now, although the water brought in by this 'Gibraltar Current' is a few degrees cooler than that with which it meets in the basin it enters, I think it clear that this inflow can have very little influence upon the general temperature of the vast mass of water which occupies the Mediterranean basin. For the inferior salinity of the Atlantic water thus drawn in, keeps it at the surface (as I have ascertained by Specific Gravity observations) notwithstanding its lower temperature; and it cannot sink until it has been sufficiently concentrated by evaporation to attain the salinity of the ordinary Mediterranean water, in the course of which process it must acquire from above the Heat which is required to bring it up to the general Mediterranean standard. And, as a matter of fact, I found myself quite unable to trace the cooling influence of the Gibraltar current farther east than a line joining Cartagena and Oran. Hence, as the entry

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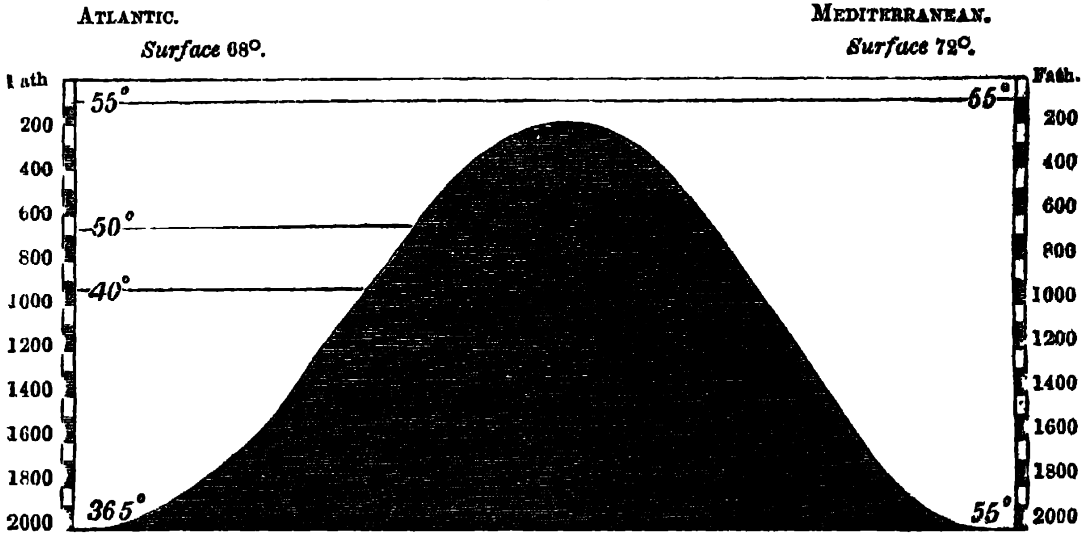
* These results are given in detail in my Reports to the Royal Society; 'Proceedings' for 1870, p. 193, and 1872, p. 578.

Diagram I.



of the deeper and far colder strata of Atlantic water is effectually barred by the shallowness of the ridge that forms what may be called the 'marine watershed' between the two Seas, we may discuss the thermal peculiarities of the Mediterranean as if its basin were completely closed.

The extension of the Mediterranean basin in the East and West direction, brings its whole area under Climatic conditions almost as nearly identical, one part with another, as those of any of the larger Swiss lakes. For the parallel of 36° N. Lat.,—which passes from the Strait of Gibraltar to the mouth of the Orontes, between the two Maltese islands, between Crete and the Morea, and between Cyprus and Asia Minor, through 42° of Longitude,—has nearly the whole of the Western basin lying within 7° Lat. to the north of it, while nearly the whole of the Eastern basin lies within 4° Lat. to the south of it. The Climatic uniformity hence resulting is strikingly shown in the course alike of the Summer and of the Winter Isotherms. For the southern boundary of the Mediterranean nearly coincides with the Summer isotherm of 80°, which closely follows its African coast-line; and since even its most northerly portions (the Gulfs of Lyons and Genoa, and the head of the Adriatic) lie very little beyond the summer isotherm of 75°, we may consider its general surface as subject to a mean Summer air-temperature ranging between 75° and 80°. So we may consider the mean Winter air-temperature over the Mediterranean area as ranging between 50° and 55°; only the northernmost extensions of that area lying beyond the Winter isotherm of 50°.

Now the Surface-temperature of this Sea at different seasons follows very closely the Air-temperature; being usually somewhat lower in summer (especially when the dryness of the atmosphere favours evaporation), and somewhat higher in winter. But while its Winter-temperature is uniform, or nearly so, from the surface to the bottom—even at 2000 fathoms' depth, the high Summer-temperature of the surface shows a rapid reduction in the subjacent strata; coming down in the Western basin from 70°, 75°, or even 80°, to about 58° Fahr., at a depth of 50 fathoms, and to 55° at 100 fathoms, at which point it ceases to descend further; and in the Eastern basin to 64° at 50 fathoms, 59° at 100 fathoms, 57½° at 200 fathoms, and 56½° at 300 fathoms, below which point it ceases to descend further. Thus we have in the Western basin an enormous stratum of water having a thickness ranging to 1400 fathoms (8400 feet), and in the Eastern basin a stratum of 1700 fathoms (10,200 feet), whose temperature is alike *uniform* from above downwards, and *constant* through all seasonal changes;

and the coincidence of this uniform temperature with the ordinary Winter-temperature of the upper variable stratum, leaves no room for doubt that it represents the *mean winter-temperature* of the Mediterranean area,—the slight difference between the constant Temperatures of the two basins corresponding with the slight difference in their Latitudes.

It is obvious on a little consideration that such would theoretically be the case. Suppose the mean winter-temperature to be *lower* than it is, the cooling of the surface-water would produce a downward convection-movement, which would reduce the temperature of the deep stratum; and this, being below the range of solar radiation, or even of the downward convection of heat from the surface, would not have its temperature raised again, when the return of summer warms the superficial layer. If, on the other hand, the mean winter-temperature were to be *higher* than it is, even the deepest stratum, having nothing to keep down its temperature, would *in time* become warmed by conduction up to the winter standard of the superficial layer.

The influence of Salinity upon the thickness of that sub-surface stratum which is affected by Heat acting on the surface, is well shown by comparing the Thermal condition of the Mediterranean basin with that of the Swiss Lakes. For whilst the temperature of the deeper portion of the former is as uniform as that of the deeper portion of the latter, there is a marked excess in the depth to which seasonal variations extend from the surface downwards. Instead of being limited to 100 feet—the extreme depth to which the influence of solar radiation can be traced in the Swiss lakes,—the effect of the heat applied to the surface of the Mediterranean shows itself very perceptibly in the Western basin at 50 fathoms (300 feet), and in a slighter degree at 100 fathoms, and in the Eastern even to more than 200 fathoms; the excess in the latter being accounted for by the greater power of the solar rays, and by the greater heat and dryness of the winds to which its surface is subjected, producing a greater evaporation and concentration. And we thus plainly see how very much more potent is the *downward Convection of Heat*, in the case of Salt water, than direct *Solar Radiation*, whose power of penetration can scarcely be greater in salt water than in fresh.

The uniformity of Temperature in all but the superficial stratum of this vast basin, seems to have a very important influence on the Biological condition of its bottom: since the absence of any change in the Thermal equilibrium of its deeper stratum, will leave its Static equilibrium entirely undisturbed; so that the whole of that mass of water in the Mediterranean basin, which is removed by its depth from the action of winds and tides on its surface, must be in an absolutely stagnant condition, which, as I have shown on a former occasion,* renders it incapable of supporting Animal life (in any quantity at least) at great depths, except near its western *embouchure.*

Thermal Condition of the Red Sea.—The Red Sea presents us with another case in which the Bottom-Temperature seems exclusively dependent on local conditions. For the greater part of the Strait of Babelmandeb is so extremely shallow, that none but the warm surface-water of the Arabian Gulf can enter through it; and the quantity of the cooler water of the sub-surface stratum which can find its way inwards through the deeper passages of the Strait, must be quite insignificant in comparison with the great mass contained in a basin more than 1000 miles long, whose depth ranges to between 600 and 700 fathoms. Now, as this indraught, like the Gibraltar current, is entirely due to the excess of evaporation over precipitation in the Red Sea area, and as the water which thus enters the basin is of lower salinity than that which it finds there, it must float on the surface, until its Temperature has been raised by insolation, so that its Specific Gravity is augmented by evaporation. And it seems to me, therefore, beyond question that its influence on the Temperature of the subjacent mass must be trivial, in comparison with that of the powerful insolation and heated atmosphere to which the surface-water of the Red Sea is exposed during a large part of the year.

That there is not over the Red Sea area by any means the same uniformity of Climatic condition as that which prevails in the Mediterranean, might be anticipated from the direction of its long axis, which lies about N.N.W. and S.S.E., and ranges through about 15° of Latitude. But the range of Temperature, whether local or seasonal, is much less than the difference of latitude between its two extremes would lead us to anticipate. For the whole of its area lies between the two Summer Isotherms of 90°, of which one crosses its northern and the other its southern extremity; while its middle portion lies between the two Isotherms of 95°. Its northern extremity lies just outside the Winter Isotherm of 60°, while it is crossed by the Winter Isotherm of 70° a little to the south of Mecca, and by that of 75° near its southern extremity. The mean Winter air-temperature of the whole area may thus be somewhat below 70°. Now the monthly means of the surface-temperature of the water differ singularly little;—ranging only from 78°·7 in January to 88° in September. And although the extreme range is rendered very considerable by the occasional extraordinary superheating of the surface-water—the thermometer having been seen to stand at 100°, 106°, 100°, and 96° on four consecutive days, while the air-temperatures on the same days were 80°, 82°, 83°, and 82°—it is quite exceptional for the surface-temperature to fall many degrees below the 70° which may be regarded as the average Isocheimal of the entire basin. Now this, so far as we at present know, corresponds with the *constant* and *uniform* Temperature of all but the variable upper stratum of Red Sea water; the thickness of which seems to be much the same as in the Eastern basin of the Mediterranean. For Capt. Pullen found that with a surface-temperature rising even to 86°, and a temperature at 50 fathoms of 77°, the thermometer sank to 71° at a depth of 200 fathoms, and then continued stationary to the bottom at 678 fathoms. And Sir George Nares found the water of the Gulf of Suez in February to be 71° from the surface to the bottom at 450 fathoms; its superheated stratum being brought down to that standard by the cooling influence of the atmosphere above, but being prevented from showing a more than slight and temporary reduction beneath it, by the existence of the great mass of water of that temperature beneath. For whenever a surface-film may have been so far cooled by a low air-temperature as to sink, its place will be taken by the ascent of water of 71° from beneath. A *continuous* interchange of this kind would of course lower the temperature of the whole subjacent water; but it is probable that it is not sufficiently prolonged to affect more than the variable stratum, the temperature of which will be quickly raised by the downward convection of Heat, so soon as the sun begins to approach the Equator.

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* See "Further Enquiries on Oceanic Circulation," in 'Proceedings of Royal Geographical Society,' 1874, Par. 41.

It seems clear from these two instances, that the seclusion of the deeper part of a Marine basin from the influence, whether direct or indirect, of the Solar Rays upon its surface, has no other effect upon the Thermal condition of its contained water (and consequently of its Bottom-Temperature), than that of preventing that temperature from being raised, during the warmer part of the year, above that which belongs to the upper stratum during its colder part; thus leaving it constant through the whole range of seasonal variation. And this conclusion is in entire accordance with the strongly contrasted results of similar observations in Seas whose surfaces are subjected to extreme winter Cold, whilst the deeper parts of their basins are secluded from the influence of warmer water outside; as is the case with the Sea of Okhotsk.

Thermal Condition of the Sea of Okhotsk.—This is a basin of no great depth, lying between the same parallels of Latitude as the British Isles, and shut in by the peninsula of Kamtchatka, the large islands of Sagalian and Yesso, and the chain of the Kurile islands, between all which the Straits are shallow. Dr. Horner, who accompanied Krusenstein's Expedition in 1803, found that with a surface-temperature in August of 46°·4, the thermometer sank in this Sea at only 18 fathoms to 31°·6, and at 60 fathoms to 29°, which temperature continued constant to the bottom at 115 fathoms. Thus it is obvious that the deeper water permanently retains the influence of the low Winter air-temperature of that region, which lies between the January Isotherms of + 20° and − 20° Fahr.; only the superficial stratum of about 50 fathoms' thickness having its temperature raised by the warmth of the Summer, although it is crossed by the July isotherm of 60°.

Thermal Condition of the Arctic Basin.—The Temperatures taken at various depths within the North Polar area by Scoresby, Parry, Ross, Martins and Bravais, and more recently by Payer and Weyprecht, Leigh Smith, and other observers, may be regarded as indicating that beneath a variable surface-stratum, the temperature and thickness of which depend partly on the season, and partly on the extension into that area of the warm upper-flow commonly designated the Gulf-Stream, there lies a great depth of proper Polar water, the temperature of which is from 30° to 28° Fahr. Still lower temperatures, it is true, have been occasionally noted; two of 27° by Mr. Leigh Smith in 1873; one of 25°·75 by Sir Edward Sabine in Ross's Expedition, 1818; and one of 22°·5, and another of 22°·3, by Mr. Leigh Smith in 1873. With regard to the last three of these I must own myself sceptical; thinking it more probable that the instruments which recorded them were faulty, than that water should have remained at the surface without either freezing or sinking, until cooled down to 25°·75, or even to 22°·3; and should have carried those extremely low temperatures down to the bottom, still remaining liquid. And I place more confidence in the recent observations of Sir George Nares; who found that when Temperature soundings were taken through holes bored in the 'palæocrystic' ice, the thermometer at all depths, from just beneath the ice to the bottom, showed a temperature of 28°. This, as I have already shown, is exactly what theory would lead us to anticipate; 28° Fahr. being the lowest temperature to which surface-Cold can bring down Sea-water without causing it to freeze, unless the water be kept quite motionless; and the freezing of the surface-stratum being only possible when the whole subjacent mass has been cooled to 28°. And as this temperature, in the absence of any agency that can exert more than a slight and temporary effect, will be permanently maintained, we seem justified in regarding 28° as the constant and uniform temperature of all but the superficial stratum of the contents of a Polar basin subject only to local conditions.

Local Effects of Vertical Convection-Movements.—Thus, then, the Bottom-Temperature of any deep basin of Sea-water subjected to local influences alone, will be essentially determined by *vertical convection-movements.* Such movements *must* be generated, as every Physicist knows, by any cause that so disturbs the Equilibrium of the mass, as to make its upper stratum specifically heavier than its lower. In the case of *fresh* water, such disturbance can only be produced by difference of Temperature; and this will be just as effective, and will operate in precisely the same manner, whether we apply *Heat to the bottom* or *Cold to the surface.* In fact, what I have spoken of as the *downward convection of Cold,* might just as properly be described as the *upward convection of Heat;* being an interchange of position between the warmer stratum below and the colder stratum above. And this may be demonstrated in a laboratory-experiment, as well by applying a piece of ice to the surface of water in a tall jar, as by applying a lamp to the bottom of a flask. For as, in the latter case, the water ascends in the heated middle of the flask, and descends at the sides kept cool by the atmosphere—as can be readily shown by the course of particles of charcoal diffused through it,—so, in the former, the water descends in the chilled middle of the jar, and ascends at the sides kept warm by the atmosphere around.

That such convection-movements may be produced and sustained by very small disturbances in Fluid Equilibrium, occasioned by differences of Temperature, there is ample evidence. The following is a remarkable example, which fell within my own knowledge in early life, and made a strong impression upon me. Mr. West, a very ingenious mechanician at Bristol, having heard of the success of Mr. Peter Barlow's plan (1828–1832) of constructing Object-glasses for Telescopes of moderate aperture, in which the double concave of flint-glass was replaced by a highly refracting fluid (such as sulphuret of carbon, or oil of cassia), carried out this plan on a large scale in the construction of an Object-glass of eighteen inches in diameter. By the mathematical aid of Mr. Barlow, and his own great mechanical ability, this object-glass (exceeding in diameter that of any Refracting Telescope which had been at that time constructed) was completed with theoretical correctness; but when it was brought into use, its performance was found to be so seriously impaired by movements produced in the fluid, by the very slight disturbances in the equality of the Temperature of its different parts occasioned by atmospheric currents, that in spite of every precaution which could be taken for its protection, it was found to be valueless for the purpose of Astronomical research.—Those, again, who have been accustomed to the minute observation of Aquaria, have frequently noticed currents, marked by the movement of minute suspended particles, that could only be attributed to slight differences of Temperature; and Prof. Möbius of Kiel,* who has given much attention to this inquiry, has ascertained that a difference of *half a degree* of Reaumur is quite sufficient to produce *sensible movement.*—Further, Mr. Rainey, who had paid great attention to the internal motions of small collections of liquid entirely enclosed within glass and placed under the Microscope, published some years since a series of observations, which show that definite currents, made obvious by the translation of suspended particles, take place in liquids thus enclosed, under conditions that seem to exclude any other agencies than inappreciable differences of Temperature.†

As there can be no reasonable doubt that similar vertical convection-movements must take place in any mass of *salt* water whose Fluid Equilibrium is disturbed by an increase in the Salinity (and consequently in the Specific Gravity) of its upper stratum, we see how such disturbance becomes the chief means of *conveying Heat downwards.* And when we duly appreciate this principle, we shall find that it can be largely applied to the explanation of many of the phenomena of Ocean-Temperature. Thus the greater depth to which the effect of surface-heat is traceable in the Intertropical portions of our great Oceans, than it is in the Mediterranean, is exactly what might be expected, when it is borne in mind that while in the latter case the heat is seasonal only, it is constant in the former, the surface of the sea being subjected through the whole year to the rays of a nearly vertical sun. And it seems probable (as Mr. Buchanan has shown‡) that it is in virtue of the greater Salinity of the water of the Gulf-Stream, produced by the excess of evaporation from its surface, that the accumulation of that water in the middle portion of the North-Atlantic carries down a temperature of above 60° to a depth nowhere else met with, and thus makes this portion of the basin a storehouse of warmth for the north-western and northern shores of Europe.

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* See 'Annals of Natural History,' Series 4, vol. viii. p. 201.

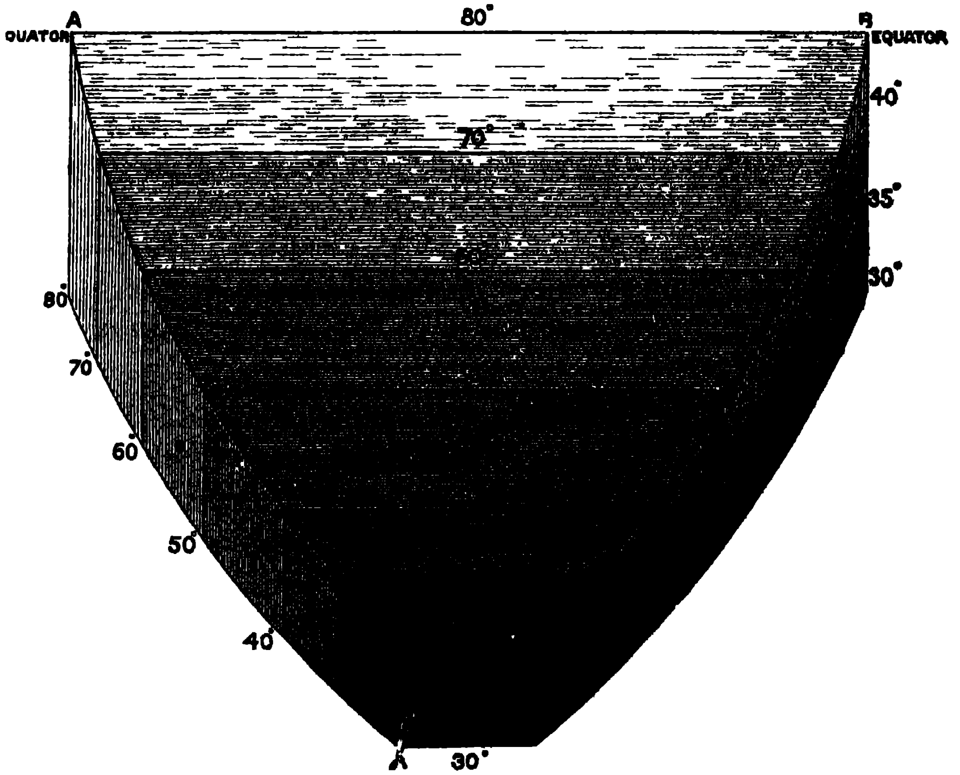
† 'St. Thomas's Hospital Reports,' New Series, vols. i. and ii.

‡ 'Proceedings of the Royal Society,' vol. xxiv. p. 597.

Where these two agencies are acting together,—the Specific Gravity of one stratum being augmented by Cold, whilst that of another is augmented by increase of Salinity,—the problem becomes a complicated one; the state of disturbance of Fluid Equilibrium, and the consequent upward or downward direction of the Convection-movement tending to restore it, being only determinable by an exact computation based on the relative Temperatures and Specific Gravities of the different strata. A large mass of material for such computation has been collected in the 'Challenger' Expedition; and it is much to be desired that it should be worked up by some Physicist competent to the task. I confine myself at present to those great general phenomena, in regard to the conditions of which, as it seems to me, there can be no reasonable question.

If, taking as our basis the Thermal condition of the Mediterranean and Red Sea, we were to frame a Temperature-section of (say) the South Atlantic basin, from the Equator to the Antarctic ice-barrier, taking account only of the *local* or *surface*-influences which affect the temperature of each zone, we should have to represent the thermal condition of that vast mass of its contained

Diagram II



water which lies between the upper variable stratum and the bottom, by a set of Isotherms passing ***vertically downwards*** (see Diagram II., A, A), and ranging from nearly 80° at the Equator to 28° beneath the Antarctic ice. For there would be nothing to depress the bottom-temperature of even the abyssal depths that underlie the Equator, beneath the lowest mean of the surface-stratum; while, on the other hand, the temperature of nearly the entire column of Polar water would be kept down by the extreme cold of winter, to the lowest temperature at which sea-water can remain unfrozen. And since the constant temperature of the uniform stratum in each Latitude would correspond with the Isocheimal of that latitude, the succession of these vertical isotherms between these two extremes would be the same as that of the July (or winter) isotherms of the surface.

But what do we find to be the actual fact?—The Isotherms, instead of lying *vertically*, lie in almost *horizontal* parallelism, with merely an upward slope towards the Pole (see Diagram II., B, B.); so that a tolerably regular Thermal Stratification presents itself, from the bottom at 2000 fathoms or more, on some parts of which the temperature is as low as 32°·4, and scarcely anywhere more than a degree above this, to 35° at an average depth of about 1600 fathoms, and so upwards to 40° at an average of about 300 fathoms, above which the temperature rises to that of the surface with a rapidity proportionate to the approximation of the locality to the Equator. Now this is equivalent to saying that the temperature of this basin from 300 fathoms to the bottom has been *imported* from the Antarctic area; the coldest and deepest stratum beneath the Equator having flowed direct thither, probably without any considerable admixture with other water, from a zone sufficiently near the Pole for its entire mass to be under 32°; while the successive strata of below 40°, that overlie this to a thickness of 1800 fathoms or more, must consist, in great part at least, of water that has come from a zone lying between the isocheimals of 32° and 40°. What agency, then, has brought water all the way from the Antarctic area into the Equatorial portion of the South Atlantic basin, in such enormous mass as nearly to fill it?

Horizontal Convection-Movements.—To answer this question satisfactorily, we must consider what will happen when Cold is applied continuously (as by a cake of ice renewed from time to time, or by a metal box filled with a freezing-mixture) to *a limited part* only of the surface-water of a basin. The very same downward convection-movement, which progressively lowers the temperature of the entire mass of water when cold is applied to its *whole* surface, here goes on beneath the locally-cooled surface; but the place of the water which descends will be taken, not by water rising up from below, but by water drawn in from the surrounding area; whilst, on the other hand, the films of chilled water as they successively fall to the bottom, will not pile-up one on another, but will spread themselves over the bottom of the basin, thus lowering the temperature of its whole area by a *horizontal* convection-movement. This horizontal movement is a necessary consequence of the augmented Specific Gravity of the chilled films, which, according to the law of fluid pressure, will have an excess of *lateral* pressure equal to their excess of weight or *downward* pressure, and will thus take the place of the warmer and lighter water around, raising it towards the surface to take the place of that which has been drawn into the chilled area. In this manner the successive thinned-out films of chilled water will progressively pile themselves up over the *entire bottom* of the basin; and as one part of the surface-stratum after another is subjected to this influence, a larger and larger proportion of the whole contents of the basin suffers a reduction of temperature; until, by a persistent application of cold to the same spot, the entire mass will be as effectually cooled down, as if the cold had been applied to its entire surface,—more slowly, however, on account of the exposure of the unchilled portion of the surface to a higher air-temperature. But even a considerable elevation in the temperature of the surface-layer by the direct application of heat to some other part of it, will only *retard* the cooling of the mass beneath; requiring an increased expenditure of Cold (so to speak) for the reduction of the temperature of the warmed water that is drawn into the chilled area.

Now this will be as true of a large basin as of a small one. Supposing the whole of the South Atlantic to be filled with water of the temperature (say) of 60°, and the part of it within the Antarctic Circle to be covered with ice at or below the temperature of 28°,—it is obvious that the continued refrigerating effect of this ice will be progressively to lower the temperature of the entire mass of South Atlantic water, except that of the stratum whose temperature is kept up either by the direct application of surface-heat—as in the Equatorial and Temperate Zones,—or by the horizontal convection of heat from those zones by surface-movement.

This plain and obvious deduction from the fundamental principles of Physics has been designated as the "Gravitation Hypothesis"; as if there could be any doubt of the fact that the coldest—because the heaviest—Sea-water *must* find its way to the bottom (unless its salinity has been reduced by dilution with fresh), as certainly as a stone falls to the ground. Any one who denies this, must be prepared either to disprove the accepted laws of Fluid Pressure, or to prove that Water is not a fluid.

Thermal Condition of the Pacific.—Let us now test this conclusion by applying it to the far vaster basin of the Pacific, which ranges from the Antarctic to the Aleutian islands, over (speaking roughly) one-third of the circumference of the globe. Now if the temperature of each part of this enormous area were determined, like that of the Mediterranean, by local influences alone, we should find it to correspond in each parallel of Latitude with the surface-Isocheimal, or mean Winter-temperature, of that latitude; thus ranging from between 70° and 80° in the Intertropical zone, to 60°, 50°, and 40°, in the successive parallels of the North and South Temperate zones, and only descending towards 35° as the northern and southern parallels of 60° are approached.

But what do we find to be actually the case? Wherever the Sea-bed of this vast area lies at a greater depth than 1500 fathoms, it is covered by a stratum of water having a temperature below 35°; and where, as is generally the case, the total depth is very great,—being very commonly 2500 fathoms, frequently exceeding 3000, not unfrequently ranging downwards to 3500, and in some instances exceeding 4000,—this stratum shows an enormous thickness, ranging from one to two miles. As the northern and southern boundaries of the Pacific basin are approached, the isotherm of 35° rises towards the surface; so that in a sounding taken by the 'Tuscarora' in Latitude 43° 21′ N. (almost exactly the parallel of Bayonne), the surface temperature being 43°, water below 35° was met with at less than 20 fathoms' depth, and water of 33°·3 from a depth of 50 fathoms to the bottom at 4041 fathoms; while in a sounding taken by the 'Challenger' in 53° 55′ S. Lat., the surface-temperature being 37°·2, the thermometer sank to 35° at a little below 60 fathoms' depth, to 33° at 70 fathoms, and thence slowly to 31° on the bottom at 1950 fathoms.

Now since the vast basin of the Pacific is virtually cut off from the Arctic basin—Behring's Strait which forms the sole communication between the two being not only narrow, but so shallow as to be only able to give passage to the warm in-going current—and since the share in this great effect that can be attributed to the winter cold of Behring's Sea must be comparatively insignificant, it becomes obvious that nearly the whole of the mass of almost ice-cold water which lies on the Pacific Sea-bed, must have found its way over its area from its Antarctic frigorifier, passing beneath the surface-heated stratum of the Equatorial Zone to the extreme

Northern border of the basin, and there rising from a depth of 1500 fathoms to within 100 feet of the surface.

This, it must be obvious to you, is perfectly in accordance with Physical Theory; which further explains what at first sight appears a great anomaly in the distribution of Ocean Temperature,—the immense predominance in the effect of the surface-Cold applied over a very limited area, over that of the surface-Heat applied over an area many times greater. For, as I have shown you, Cold applied to the surface is (so to speak) *wholly taken into* Oceanic water, and operates in reducing the temperature of its *entire mass;* whilst of the Heat applied to the surface, a very small proportion is operative in raising the temperature of the mass (such elevation being limited to its *superficial* stratum), by far the larger part of it being *expended in vaporisation* and being thus imparted (in a latent form) to the Atmosphere, by the currents of which it is conveyed to the remotest distances. It is thus that what Sir John Herschel termed (in the letter to which I have already referred) "the more *intense* action of Polar Cold" is produced; and in his use of this word he seems to me to have distinctly recognized the main point of my case.*

What other possible agency than Gravitation, acting in the manner I have described, can have thus filled all the deeper part of the Pacific basin with water whose temperature unmistakeably demonstrates its Antarctic source, the opponents of what they are pleased to call the "gravitation hypothesis" have not informed us.

Thermal Condition of Limited Submarine Areas.—I shall now test this conclusion by the facts recently ascertained in regard to the Thermal condition of certain Submarine Areas, which, while in free communication with the General Oceanic basin as regards their upper strata, are cut off from it beneath by ridges rising to a greater or less elevation from the Sea-bed.

Let us first consider what, in an elongated trough, would be the effect of partially cutting off one end by a partition rising to any given height from the bottom, and then applying surface-cold to the other end. Supposing the whole trough to be originally occupied by water of 60° Fahr., the downward and then horizontal convection from the chilled surface will pile up on the bottom one stratum of water of (say) 40° over another. This will in the first instance be kept out of the secluded area, so that the water within it will retain its temperature of 60°. But as soon as the water of 40° rises above the top of the partition, the chilled stratum will extend itself over the water in the secluded area, with which it will exchange places by gravitation; and the overflow of one stratum after another into that area will gradually replace the whole mass of water at 60° by water at 40°. Supposing, however, that by the continued application of surface-cold, the temperature of the deepest stratum were further reduced,—say to 35°, but that this reduction did not extend to the height of the partition; it is obvious that as there would be no overflow of the water of 35° into the secluded area, the temperature of its bottom and of its deeper stratum would continue at 40°—that of the coldest water that *can* enter it.

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* "You have brought out with singular emphasis the more powerful action of "Polar Cold,—or rather the more *intense* action, as its maximum effect is limited "to a much smaller area than that of the maximum of Equatorial Heat."

Now the Sulu Sea is a small basin lying between the north-east angle of Borneo, the south-west promontory of Mindinao, and the Sulu Archipelago. Although not ostensibly an Inland Sea, being but very partially enclosed by land, it is so surrounded by reefs and shoals, that the deeper portion of its basin, which ranges downwards to 2550 fathoms, seems to be as completely secluded from the Celebes Sea on one side, and from the China Sea on the other, as all but the superficial part of the Mediterranean basin is from that of the Atlantic. With a surface-temperature of 82° Fahr., Sir G. Nares found the thermometer fall rapidly to 60°, this isotherm being reached at about 120 fathoms; the isotherm of 55° lay at about 200 fathoms; from this the thermometer fell to 50°·5 in the next 200 fathoms; while from 400 fathoms to the bottom, the thermometer continued to show the uniform temperature of 50°·5. (See 'Proceedings of Royal Geographical Society' for 1875, plate I., sect. vi.)—It is clear that this uniform standard of temperature cannot be determined, as is the case with the Mediterranean, by the action of Cold on the surface; for the Sulu Sea lies within 10° of the Equator, and its February mean is about 79° Fahr., so that, if there were no importation of cold water, that temperature would prevail to its greatest depths. But owing to the seclusion of the deeper part of its basin, such importation is limited to the upper stratum; and as the isotherm of 50° lies within 200 fathoms of the surface, alike in the China and in the Celebes Seas the Sulu basin may be pretty safely affirmed to have no considerable communication with them much deeper than this. For at 400 fathoms—the depth at which the uniform temperature is first met with in the Sulu Sea—the temperature alike in the Celebes and in the China Seas, is about 42°; and it is clear that water much below 50° must be entirely excluded from the Sulu basin.

Here, again, I am entirely at a loss to conceive by what other agency than Gravitation, this deep hollow can have possibly come to be occupied by water of 50°·5, piled up on its bottom to more than 2000 fathoms' thickness. It was suggested in the first instance by Sir Wyville Thomson, that in the area of the Sulu Sea evaporation is in excess of precipitation, so that an *in*flow of water from the outside is needed to supply the deficiency and keep up its level. But this supposition is completely negatived by the fact stated by Staff-Commander Tizard, that the Specific Gravity of the water of the Sulu Sea, like that of the Celebes and Banda Seas, is *lower* than that of the surface water of the Pacific; which clearly proves an excess of precipitation over evaporation, causing an outflow instead of an inflow.

The same condition obviously determines the bottom-temperature of the Celebes and China Seas themselves. In the former, which lies nearly under the Equator, the thermometer rapidly descends, from a surface-temperature above 80°, to 50° at about 200 fathoms, and thence falls to 45° at 300 fathoms, to 40° at 500, to 39° at 600, and to 38°·5 at 700, continuing uniform at the last point down to the bottom at 2600 fathoms. In the latter, which lies further from the Equator, the surface-temperature is lower, and the isotherm of 50° is reached a little sooner; but the isotherm of 45° still lies at about 300 fathoms, and that of 40° at 500, as in the Celebes Sea. Below that point, however, the temperature descends somewhat more rapidly, and continues to do so down to 900 fathoms, where the thermometer sinks to 36°·2, at which uniform standard it remains, down to the bottom at 1050 fathoms.

In the Banda Sea, again, which lies within 5° of the Equator, the temperature falls rapidly, from above 80° at the surface, to 50° at something more than 200 fathoms; its descent is then slower to 40° at 600 fathoms, the reduction continuing to 37°·5 at 900 fathoms, from which to the bottom at 2800 fathoms the temperature is found to be uniform at the same standard. This sea communicates with the Pacific only by a series of narrow channels, and seems rather to depend for its temperature upon the Arafura Sea to the south of it, the temperature of which is dominated by that of the Indian Ocean; and it is clear that a barrier exists at a depth of about 900 fathoms, preventing the admission of water of a more glacial coldness than 37°·5, whilst giving free entrance to the upper stratum whose temperature is above that standard.

A yet slighter elevation of the bottom-temperature of one area above that of an adjacent area in perfectly free communication with the Antarctic, has been attributed by Sir G. Nares with great probability to the intervention of a ridge at such a depth as would cut off only the very coldest stratum. For as the 'Challenger' proceeded directly northwards from New Zealand to the Fiji Islands, the bottom-temperature was found to be 32°·9 at a depth of 2900 fathoms. But in proceeding westwards from the Fiji Islands through the Melanesian Sea towards Raine Island at the entrance of Torres Strait, while the depth ranged from 1350 to 2650 fathoms, the temperature never fell below the 35°·1 which was reached at 1300 fathoms; and as this was the depth usually met with between the Fiji Islands and New Hebrides, Sir G Nares considered it almost certain that the deeper part of the Melanesian Sea is enclosed by a ridge extending from Sandy Cape on the coast of Australia to New Caledonia, and thence to the New Hebrides, Solomon Islands, and New Guinea; the surface of this ridge nowhere lying at a greater depth than 1300 fathoms, while the deeper water it encloses, in the hollow between the New Hebrides and Torres Strait, is comparatively stagnant, as in the Mediterranean and other secluded seas. This conclusion was fully confirmed by the subsequent Temperature-soundings of the 'Challenger' in the nearest part of the North Pacific; which showed the prevalence of a lower temperature than that of the supposed secluded area, on the outside of its northern, as well as of its southern and eastern border.

Bottom-Temperature of the Atlantic.—The information now obtained with regard to the conditions of the small variations in bottom-temperature which present themselves on different parts of the great Atlantic area, makes these variations perfectly intelligible, and shows how completely they are determined by the degree of freedom with which the deepest and coldest stratum of Polar water is allowed by the contour of the Sea-bed to find its way over the several portions of the area on which these diversities are observable.

Let us take, in the first instance, the striking difference in abyssal temperature between the Northern and Southern divisions of the great Atlantic basin.—In my discussion of the Temperature-observations made in the 'Porcupine' Expedition of 1869,* I pointed out that combining with our own observations made with 'protected' thermometers, those taken not long previously by Commander Chimmo and Lieutenant Johnson with 'unprotected' thermometers, and making the requisite correction in the latter, we

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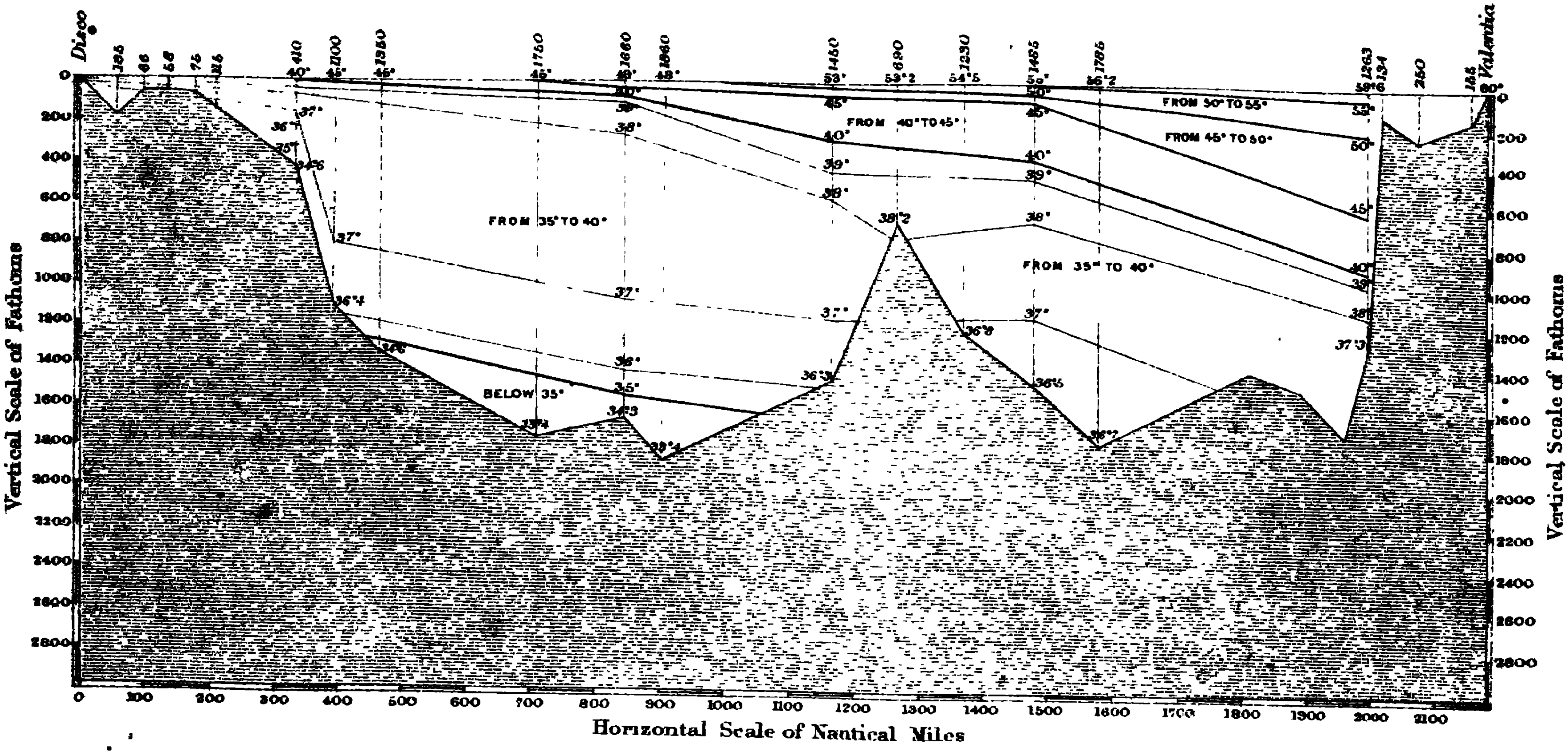
* 'Proceedings of the Royal Society,' vol. xviii. p. 472.

SECTION OF NORTH ATLANTIC OCEAN BETWEEN DISCO & VALENTIA



W & A K Johnston

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might estimate the general temperature of the deeper parts of the *North* Atlantic at about 35°; the reduction to this point being determined by the flow of glacial water in limited amount from the Arctic into the North Atlantic basin. But I further pointed out (p. 473), that the unrestricted communication which exists between the *Antarctic* area and the *South* Atlantic basin would allow a much larger body of cold water to pass from the former into the latter; thus producing a reduction in the temperature of the deepest parts of the South Atlantic below that of the abyssal depths of the North Atlantic—probably to 32° or lower; and not improbably carrying a temperature of 32° as far as the Equator, or even to the north of it.

These predictions have been fully verified by the 'Challenger' temperature-soundings. For (1) the abyssal temperature of the North Atlantic was everywhere found to range between 35° and 36°; except either in the passage to Halifax, N.Sc., where a slight depression was observable, which might fairly be attributed to the nearer approach to the source of the Arctic underflow; or in the neighbourhood of the Equator, where the influence of the Antarctic underflow made itself apparent. In the western half of the South Atlantic, on the other hand, the Sea-bed is covered by an abyssal stratum of water of several hundred fathoms' thickness, the temperature of which ranges downwards from 35° to 31°; and this not only extends as far as the Equator, reducing the bottom-temperature between St. Paul's Rocks and Fernando Noronha to 32°·4, but seems traceable as far north as the neighbourhood of St. Thomas's, where the thermometer indicated a reduction of nearly a degree below the general Bottom-Temperature of the North Atlantic. (See Chart of Atlantic.)

Again (2) the *rationale* which I suggested for the higher bottom-temperature of the North Atlantic, has been fully borne out by the recent Temperature-soundings of the 'Valorous.' The principal, indeed almost the only direct channel of communication between the deeper parts of the Arctic and the North Atlantic basins, is in the interval between Greenland and Iceland; for between Iceland and the Faroe islands there is a shallow ridge over which no glacial water can flow; the 'Lightning Channel' between the Faroe and Shetland islands cannot give passage to any large body of glacial water; and the shallowness of the North Sea between Shetland and the shore of Norway makes it as it were a coast-line to the deeper water of the Arctic basin. Now, whilst near the mouth of Davis's Strait, and for some distance to the S.E. of Cape Farewell, the Temperature-soundings of the 'Valorous' (see Section) showed that at depths exceeding 1660 fathoms, the bottom-temperature ranged downwards to 33°·4, it rose to 36°·3 with an elevation of the bottom to 1450 fathoms, while on the summit of this elevation, which lay at only 690 fathoms' depth, it was 38°·2. To the north of this elevation, again, there is evidence of another yet shallower ridge, reducing the depth of the "Denmark Strait" between Iceland and Greenland to less than 500 fathoms. And thus, the passage of water below 35°, in any considerable quantity, from the Arctic into the North Atlantic basin, being effectually barred, we see a complete explanation why the temperature of the latter only falls beneath 35° where Antarctic water spreads itself over its Sea-bed. Since, again, a perfect continuity can be traced, except where the passage of the deeper strata is interrupted by submarine ridges, between the Thermal stratification of the North Atlantic and that of the Arctic basin, I can see no reason whatever for supposing that the temperature of the North Atlantic is modified in any sensible degree by an Antarctic underflow, beyond the limit to which this can be distinctly traced by a depression of bottom-temperature below 35°. (See Chart of Northern Atlantic.)

But further, there is a marked difference between the Bottom-Temperatures of the *western* and of the *eastern* portions of the South Atlantic Sea-bed; that of the latter, between Tristan d'Acunha and Ascension island, nowhere falling below 35°·3, though between Ascension island and the Equator there is a narrow but deep stratum of water ranging downwards between 35° and 32°·7, which must obviously be an extension from the Antarctic basin. This extension is clearly traceable on the line between Tristan d'Acunha and the Cape of Good Hope; the bottom-temperature ranging downwards to 32°·9, and a considerable thickness of abyssal water having a temperature below 35°.—Now this distribution of abyssal temperatures is precisely conformable to the contour of the Sea-bed; for the "Dolphin Ridge," which divides the North Atlantic into an eastern and a western basin, seems to have its parallel in the 'Challenger' ridge of the South Atlantic; the two being connected by an oblique ridge that lies about halfway between the Guiana coast and the opposite Guinea coast (see Chart of Atlantic). And while the *western* basin is in free communication with the Antarctic, so that its glacial water flows northwards until checked by the 'connecting ridge,' the deep communication of the Antarctic with the *eastern* basin is so far interfered with, that very little of the glacial water of the former can find its way along the bottom of the latter, which consequently receives only the coldest that can flow over the ridges.

Here, again, we have a remarkable illustration of the prescience of the profound Physicist, whose early acceptance of my views I felt to be my greatest encouragement in the pursuit of this enquiry. After pointing out that the causes of the Wind (or horizontal) Circulation lie on the surface,—none of the agencies escaping our notice, and the configuration of coasts, which mainly determine their direction, being patent to sight,—he continues:—"It is otherwise with the other class of movements [those which depend on Heat, Cold, and Evaporation as *veræ causæ*]. They take place in the depths of the Ocean; and their movements, and directions, and channels of concentration are limited by the configuration of the sea-bottom, which has to be studied by the very imperfect method of sounding."* If Sir John Herschel had lived to see the series of Temperature-Sections that have been worked out by my old shipmate Staff-Commander Tizzard, from the Serial Soundings taken in the 'Challenger' under the direction of Sir George Nares and Captain F. T. Thomson, he would, I feel sure, have not only accepted them as constituting by far the most remarkable single contribution to the Physics of the Earth that has ever been made; but would have recognized the perfection to which this method of observation has now been carried by the able Officers who had charge of it, the skill with which their results have been correlated, and the soundness of the conclusions to which they have been led, as to the relation between the distribution of the Bottom-Temperature and the configuration of the Deep Sea-bed.

Confirmation of Gravitation-Doctrine by Mr. Froude's Investigations.—Since I last brought this subject before the Royal Geographical Society, the theoretical considerations on which I based my argument have received most weighty confirmation. It has been affirmed, over and over again, by Mr. Croll and others, who maintain that the distribution of Bottom-Temperature essentially depends on surface Wind-currents, that deductions from Laboratory-experiments on water in small troughs, are not applicable to great Ocean-basins; for that if we had a trough of the length of a quadrant of the earth's surface (say $\frac{25000}{4}$ miles, = 6250 miles) and a depth of (say) 3 miles, the continued application of ice to the surface at one extremity along one-tenth of its length, would *not* occasion the transmission of Cold by horizontal convection to the opposite extremity,—the disturbance of Thermal and therefore of Static Equilibrium thus produced, being quite inadequate to put the contents of the trough in movement along its whole length. No other evidence of this inadequacy, however, has ever been adduced, than a computation based on the experimental results obtained by M. Dubuat, a French Engineer, in regard to the gradient required to produce *a definite current in water moving over solid surfaces.* But, as I pointed out some years since,* these experiments are not applicable to the very different case of *a slow movement of water over water:* for if water be a *perfect* fluid, the smallest disturbance of equilibrium in any part of it will give rise to movements tending to its restoration; and in proportion to its approximation to that perfection, will be the facility with which it will be thus put in motion.

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* 'Proceedings of Royal Geographical Society,' vol. xv. p. 212.

Now what is known as the 'Stream-line Theory' elaborated by the mathematical investigations of Prof. Stokes, Sir William Thomson, the late Prof. Macquorn Rankine, and other eminent Mathematicians, has, so far as it relates to the motion of ships through water, been recently made the subject of thorough experimental enquiry by Mr. Froude; who, in the masterly Address which he delivered as President of Section G at the Meeting of the British Association in 1875, gave it as the result alike of theoretical and of practical investigation, that in estimating the forces which impede the progress of a vessel through the sea, *the friction of the particles of the water it displaces, upon each other and upon those of the surrounding water,* exerts so small a retarding influence, in comparison with their friction against the solid surface of the ship, the opposition of the bow- and stern-waves which are raised when the ship is rapidly urged through the water, and the loss by the production of eddies when its form is unsuitable, that it *may practically be thrown out of consideration.*

As this conclusion seemed to me to have an important bearing upon my own subject of enquiry, I brought the question under Mr. Froude's attention; and found him fully prepared to endorse my views, not only on general grounds, but also because they are in complete harmony with the results of enquiries he has himself prosecuted in a line exactly parallel to my own. For having had occasion frequently to observe the movement of water in harbours, lochs, and fiords, communicating with the sea at their mouths, but at the same time receiving enough fresh water from the land to lower the salinity of their upper-stratum, and to produce a slight surface-outflow, he had always been able to detect a deeper flow of Sea-water into the interior basin. And since this inflow can be attributed to nothing else than a very slight excess of downward and therefore lateral pressure in the *outside* column, depending on the continually-maintained reduction in the mean salinity of the

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* 'Proceedings of Royal Society,' 1872, p. 552.

inside column,* a similar horizontal convection-movement will equally take place when the disturbance of Static Equilibrium is produced by changes of Temperature.

Summary.—The general conclusion, then, towards which all the foregoing facts converge, is that the Bottom-Temperature of Oceanic Basins and of partially-inclosed Seas essentially depends on two factors:—(1) *downward* Convection-movements of their superficial strata, carrying to the bottom the Cold applied to their own surface;—and (2) *horizontal* Convection-movements of their deep strata, carrying the Cold applied to the surface of one area to other areas at remote distances from it. The horizontal, equally with the vertical Convection-movements, are necessary results of the constitution of Liquids; since, as their pressure is equal in all directions, a heavier (because colder) body of water has precisely the same tendency to displace lighter water by a horizontal flow, as it has by vertical descent. In a Sea entirely cut off from the Oceanic area, and not subject to any considerable local diversity of surface-temperature, the Bottom-Temperature will correspond pretty closely with the Isocheimal, or mean Winter-temperature, of the surface; and this condition will not be essentially changed by the admission of water from the Oceanic area, belonging to a stratum sufficiently near the surface to bring in a temperature not below the Isocheimal,—as happens in the Mediterranean and Red Seas. But where, as in the Sulu, Celebes, Banda, and China Seas, admission is given to water colder than the Isocheimal, the Bottom-Temperature is that of the coldest water thus admitted. And while, in the Polar areas of the great Oceanic basin, the glacial temperature of the Bottom is determined by *downward* Convection alone, the extension of that glacial temperature over the whole remainder of the basin depends on *horizontal* Convection; its slight variations being determined by the contours of the Sea-bed, which exclude the deepest and coldest flow from particular tracts. Finally, I venture to affirm that the doctrine of the essential dependence of the Bottom-Temperature of the several parts of the great Oceanic basin, on the degree of their accessibility to the horizontal flow of Glacial water from the Polar areas under the influence of Gravitation, is so completely conformable, on the one hand with Physical Theory, and on the other with the facts established by careful and extended observation, as to have a claim for unhesitating acceptance as one of the established verities of Physical Geography.

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* Those who have followed the course of my previous enquiries, will recollect that it was precisely in this manner that I explained the inward under-current of the Baltic, and predicated that of the Bosphorus and Dardanelles.

Eleventh Meeting, 14*th May*, 1877.

SIR RUTHERFORD ALCOCK, K.C.B., PRESIDENT, in the Chair.

PRESENTATIONS.—*Richard Jeffs, Esq.; Edward Herries, Esq.*

ELECTIONS.—*James Crispe, Esq.; Frederick Day, Esq.; Thomas Bradley Dickinson, Esq.; John Dickson, Esq.* (H. M. Vice-Consul at Beyrout); *Rev. John Griffiths; John Husband, Esq.; John H. B. Lytton, Esq.*, M.A.; *Alexander Scrutton, Esq.*; *John Hewitt Tomlin, Esq.; Harold J. B. Torry, Esq.* (Lieut. Royal London Militia).

DONATIONS TO LIBRARY, APRIL 23 TO MAY 14, 1877.—The following portions of the publications of the scientific results of the Voyage round the Earth of the Austrian Frigate *Novara*, 1857–1859, required to complete the copy in the Society's possession:—Nautisch-physicalischer Theil, and Kartenrolle, Medizinischer Theil, Botanischer Theil, Anthropologischer Theil, Abth. i., and Zoologischer Theil, vol. i., and vol. ii. part 1, Sections A and B, and parts 2 and 3 (*The Imp. Academy of Sciences, Vienna, per Herrn Hofrathe Dr. Ritter von Hochstetter, K. K. Ministerium für Cultus und Unterricht, on the application of Dr. Karl von Scherzer*). General Report on the operations of the Great Trigonometrical Survey of India, 1875–76 (*The Indian Government*). Imp. Meteorological Observatory, Tokei, Japan, table for 1876, with Introductory remarks, and Progress, &c., of Meteorology, Japan, by H. B. Joyner (*Author*). The best trade-route to the Lake regions of Central Africa, by E. Hutchinson (*Author*). Annales hydrographiques, No. 571, and Sér. D., No. 219 (*The French Minister of Marine*). Reclus' Nouvelle Géographie Universelle, vol. ii. (*Author*). The Grotto Geyser of the Yellowstone National Park (*Dr. F. V. Hayden*). Neues aus der Geographie, Kartographie und Statistik Europa's und seiner Kolonien, vii., 1877 (*The R. General Staff, Berlin*). The Franco-German War, 2nd part, 10th Section, translated by Captain F. C. H. Clarke (*H. M. Secretary of State for War*). Rapport sur la Mission des Chotts, Mer intérieure, par M. le Capt. Roudaire, and Rapport sur le service des Missions et voyages scientifiques en 1876, par M. le Baron de Watteville (*The French Geographical Society*). Ponts et Chaussées, Service Hydrométrique du bassin de la Seine; Résumé des observations pendant 1875, and Observations sur les cours d'eau et la pluie pendant 1875, par E. Belgrand et G. Lemoine (*The Department*). Portugal e o movimento geographico moderno, por L. Cordeiro (*Author*). A Sociedade de Geographia de Lisboa e o Marquez de Sá de Bandeira, por R. A. Pequito (*Author*). Armenia and the Armenians, by J. Issaverdens, 2 vols., and Les

Assises d'Antioche, reproduits en français (*The Armenian Academy of St. Lazarus, Venice, from Prof. Léon Alishan, per S. Baronian, Esq.*). Floods in the Thames Valley, by F. J. Palmer (*Author*). Interlaken et ses environs, par P. Ober (*Librarian R. G. S.*) Description physique de la République Argentine, par H. Burmeister, traduite par E. Daireaux, vol. ii. (*Dr. H. Burmeister*). Financial Statement of Colonial Treasurer of New South Wales, 1877 (*The N. S. Wales Government*). Le Pamir, par J. B. Paquier (*Author*). And the current issue of publications of corresponding Societies, Periodicals, &c.

DONATIONS TO THE MAP-ROOM BETWEEN 24TH APRIL AND 14TH MAY, 1877.—Map of routes travelled and discoveries made by the exploring expeditions under the command of Ernest Giles between 1872–6 (*H. M. Secretary of State for the Colonies*). Preliminary map of Eastern Turkestan; map of the Pundit's route from Ladakh to Assam, 1874; and map of the Havildar's route from Afghanistan, &c., and the Mullah's route from Jalalabad to Sarhadd-i-Wakhan, 1873–4 (*Capt. H. Trotter*, R.E.). Map of North-East Africa and Arabia; photograph (*General Stone, Chief of General Staff, Egyptian Army*). Map of Aberdeenshire, &c.; map of Forfarshire, &c.; Johnston's Political map to illustrate "The Eastern Question;" war map of Turkey in Europe; and war map of Turkey in Asia and Transcaucasia (*Messrs. W. and A. K. Johnston, publishers.*) Map of Nippon (Japan), Yezo, &c., by R. H. Brunton, M.I.C.E., F.R.G.S., Trübner, Ludgate Hill (*Author*).

The PRESIDENT said the Paper to be read gave an account of the remarkable journey of Nain Singh across Thibet in 1874–5, and was drawn up by Captain H. Trotter, R.E., Deputy Superintendent of the Trigonometrical Survey of India. It was Captain Trotter's intention to have given the Paper a wider scope, by including in it several other recent explorations in Central Asia, which had been carried out under his superintendence, or by himself personally, viz. the journeys of two other *employés* of the Trigonometrical Survey, surnamed "the Havildar" and "the Mollah," through previously unknown parts of Western Turkistan, and his own important explorations north of Kashgar and across the Pamir Steppe. He had, however, suddenly received orders to proceed on service to the East, and had been unable, in consequence, to finish the Paper in time for the present Meeting. It was fortunate that the journey of Nain Singh could be given with considerable completeness, this being of some interest to the Society at the present time, as the Council had recently awarded to the Pundit the Patron's Medal for his meritorious explorations.

Account of the Pundit's Journey in Great Tibet from Leh in Ladákh to Lhása, and of his Return to India viâ *Assam.* By Captain H. TROTTER, R.E.

[ABRIDGMENT.]

NAIN SINGH, the explorer who undertook this journey, is the original Pundit whose journey to Lhása in 1865 from Katmandhú, the capital of Nepál, was described at length by Colonel Montgomerie, R.E., in the 'Trigonometrical Survey Reports' for 1866–67. The Pundit had been in the service of the brothers Schlagintweit while they were carrying on magnetic and other scientific observations in Ladákh and Kashmir in 1856 and 1857; he was subsequently appointed Head-master in a Government Vernacular School in his native district of Milam in Kumaon, and remained in the Education Department until 1863, when, at the instance of Colonel J. T. Walker, R.E., the Superintendent of the Great Trigonometrical Survey, he was entertained for employment as a Trans-frontier explorer and duly trained. From that time to the present he has been constantly engaged either in carrying on explorations himself, or in training other natives to follow in his footsteps. In 1865–66 he made the famous journey, alluded to above, from Katmandhú to Lhása, and thence to the Manasarowar Lake and back to India. This exploration earned for him the present of a gold watch from the Royal Geographical Society of London, which, unfortunately, was subsequently stolen from him by one of his own pupils. In 1867 he went in charge of a party of natives, and did excellent service in exploring and surveying the head-waters of the Sutlej and the Indus rivers. In 1870 he was deputed to accompany Mr. (now Sir Douglas) Forsyth's first mission to Yárkand, but shortly after the Mission left Leh he was sent back to India. In 1873, he was sent under Captain Trotter's orders with Sir Douglas Forsyth's second mission to Yárkand, in connection with which he did much good service. In July 1874, while at Leh, after the return of the Mission, the Pundit having volunteered to make a fresh exploration, Captain Trotter was authorised by Colonel Walker, R.E., to despatch him on the journey to Lhása now to be described. His instructions were to proceed by a much more northerly route than the one he had previously followed. From Lhása he was to endeavour to get attached to the caravan which proceeds thence every three years to Pekin. If he failed in accomplishing this, he was to endeavour to return to India by an easterly route from Lhása, down the course of the Brahmapútra if possible.

On the 15th July, 1873, the Pundit and his companions left Leh. On the 21st they reached Tánksé, three marches further on; at Chágra, they found a summer-encampment of shepherds, the last inhabited spot on the road to Yárkand.

From Chágra they followed the Changchenmo route to Yárkand, halting at the foot of the Lankar or Marsemik Lá (Pass). On the following day they crossed the pass (18,420 feet high) and then quitted the Yárkand road, and turned off to the east; crossed the

Kiu Lá, still higher than the Marsemik, and encamped for the night at Pángur Gongma, after a march of 9 miles.

The Pundit was obliged to travel slowly, as the whole of his worldly possessions—including tent, bedding, and commissariat for the whole party—had to be carried on the backs of sheep. It is astonishing what admirable beasts of burden these animals make in a pastoral country. The Pundit started with twenty-six sheep from Tánksé. Of these some were eaten on the road, some became ill and were exchanged for fresh ones; but four or five of the original lot reached Lhása, having, in less than four months, carried loads of from 20 to 25 lbs. each, over a distance of more than 1000 miles. Throughout the journey they never received a single ounce of food beyond what they could pick up for themselves on the road and at the camping-grounds.

On the 28th of July the party descended to Ningri, and on the following day reached Niágzu Rawang.

From Niágzu six short marches brought our travellers to Noh. The country through which they passed was almost uninhabited; a few solitary tents belonging to the Noh shepherds, and a single hut, occupied by a frontier guard, were the only inhabitants passed *en route.*

Noh is a small village in the Rudokh district, containing about twenty huts, built of stones cemented by mud. It has a small permanent population, which is increased largely in the winter months by numerous shepherds, who during the summer are scattered in tents in twos and threes, in whatever parts of the district grass and water are to be found in sufficient abundance for their numerous flocks of sheep and goats.

The province of Western Tibet is frequently termed Nari Khursum. The inhabitants of the northern portion, i.e. the district through which the Pundit travelled, are called by the settled population to the south Champas or *Changpas*, i.e. literally, *Northmen.* By the inhabitants of Turkistán they are called *Tághlik* or mountaineers. The Champas encountered by the Pundit were, contrary to the generally received opinion of them, quite inoffensive people, of the same class as the people of Rudokh and the more civilised districts farther south. They are all Buddhists.

The road near Noh skirts the Pangong Lake, which at Noh is joined by a stream from the north-east, up which goes a good road to Khotan, *viâ* Polu and Kiria.

The distance to Khotan by this road is about 450 miles. For a distance of 40 miles from Noh it gradually rises up to a height of 15,500 feet; and then, for about 160 miles as the crow flies, crosses, in a north-easterly direction, a series of elevated plains and ridges before it descends somewhat suddenly to the plains of Eastern Turkistán. The average height above sea-level of the halting-places, on the elevated plain to the north of Noh, is 16,500 feet. This vast highly-elevated plateau, over which the road passes, is the eastern continuation of the Ling-zi-thang and Áksu Chin plains, which lie at a similar, or in places even a higher, elevation in a north-westerly direction from Noh, between the Changchenmo River and the Kuen Luen Range, and have to be crossed by the traveller who adopts the eastern (or Changchenmo) route between Leh and Yárkand. To the north of the Kuen Luen there is a rapid fall into the plains of Eastern Turkistán.

The Tibetan plateau extends eastward as far as the head-waters of the great rivers which water China—up, in fact, for a distance, as the crow flies, of more than 800 miles to the Bourhan Búda Mountains (south-west of the Koko-Nur Lake on the road between Lhása and Pekin), where, according to the Abbé Huc, and the still more recent researches of the Russian Captain Prejevalski, a table-land rises from 14,000 to 15,000 feet above the sea-level, above which tower gigantic snow-covered mountains.

Seven miles to the east of Noh is the eastern termination of the series of lakes known to us as the Pangong. Its extreme length is exactly 100 miles, while its breadth probably nowhere exceeds six or seven.

At its eastern extremity it is entered by a small stream, 3 paces broad and 1½ foot deep. Although the greater portion of this lake has been previously surveyed and described, its eastern limit has now been determined for the first time. It is a curious fact that the water at the eastern extremity is sweet and good to drink, while that at the west end is very brackish. It has been conclusively shown by Major Godwin-Austen that this lake once upon a time drained into the Shyok, but at present it forms the most western of a numerous series of inland lakes with no outlets, which we shall find stretch for a considerable distance across the elevated plateau of Central Tibet.

From Noh the Pundit toiled on for many weary marches over this Tibetan plateau; his road lay eastward along a wide, open grassy valley, varying in width from 6 to 10 miles, bounded on the north and south by low grass-covered hills, through which occasional openings gave a view of extensive plains stretching away as far as the eye could reach. Beyond the hills sometimes appeared snow-capped mountains; while an occasional shepherd's tent in the foreground, and the frequent appearance of large herds of wild asses, antelope, and gigantic wild sheep, helped to relieve the monotony of the journey. In almost every day's march large sheets of water were passed, generally salt, but occasionally fed by fresh-water springs. At the latter, the Pundit and his companions would fill their water-skins, as they rarely knew from day to day whether or no they would be able to obtain a fresh supply on the road. More than once their supply of this precious fluid was exhausted, and on one occasion the whole party were for more than twenty hours without fresh water. For fuel, also a traveller's necessary, they were better off; the *argols*, or dung of the numerous flocks of wild animals, were a never-failing source of supply, while occasionally, but rarely, firewood was obtained in considerable quantities. At Tchachap Cho, a fresh-water lake, 8 miles to the east of Noh, and the 27th halting-place from Leh, a large stream flowing from some snow-covered hills to the north-east of the lake was found to be covered on both banks with a dense forest of willow, tamarisk, and other trees and shrubs. For the first thirty marches from Noh the heights of the camping-grounds varied between 13,700 and 15,000 feet, and for the rest of the journey to Namcho the ground was somewhat higher; but there was no considerable rise or fall throughout this portion of the Pundit's route. The large, flat, open valleys traversed by the Pundit, locally termed *Sangs*, appear to be much of the same nature as the *Pámírs* between Eastern and Western Turkistán, and the *Jilgas* of Northern Ladákh. These *Sangs* of Tibet, however, would seem to have more of plain and less of precipitous mountains than either the Pámírs or the Jilgas.

The Khámpas of this plateau had migrated from their own country (near Ziling to the east of the Koko-Nur Lake) about twenty-five years prior to the Pundit's visit. They travelled *viá* Lhása and the Manasarowar Lake, near which place they plundered a caravan, and fled with their booty to their present camping-grounds, which, prior to that time, were uninhabited. Soon after settling there, they were called on by the Garpon of Gártokh to pay tribute, which they now do annually to the extent of 5000 Nák-tang or Tankas, *i.e.* about rupees 2000 (200*l.*), or its equivalent in gold, ghi, horses, and cattle. This tribute is paid in Gártokh, and a punctual payment doubtless secures a certain immunity from their peccadilloes being inquired into. They possess large herds of cattle, &c., each tent possessing from ten to sixty horses, and from 500 to 2000 sheep. They despatch annually to a fair at Gáni-ma, near Manasarowar, large quantities of sheep and goats'-wool, salt, and gold; and, according to their own account, when they have finished their mercantile transactions, they send back the cloths, &c., that they have purchased, under the escort of the older and less active members of the tribe, while the young men start on some marauding excursion, the victims of which are generally travellers and strangers to the country. The Khámpas are well armed with guns and swords, which latter are constantly worn even by boys. The scabbards are often handsomely ornamented with gold, turquoises, and coral.

The men are fine, large, broad-shouldered fellows. They wear, both in summer and winter, *postíns* made of sheep-skins, the hair being turned inside. These coats are worn short, extending to the knees only, and are fastened round the waist by a woollen girdle, above which the coat is roomy and capacious, affording ample space for the storage of their goods and chattels when on a journey. They have felt hats, resembling in shape a broad-brimmed English *wide-awake*, and leather boots with woollen tops and curved pointed toes. They have no hair on the face, and that of the head is plaited, Chinese fashion, into pigtails. The women dress very much as the men, but their postíns are longer and less roomy. They wear round leather caps and very long hair, to the plaits of which are fastened long pendants, nearly reaching the ground, profusely ornamented, chiefly with silver coins, of which the favourite is the British *rupee.* Both men and women are always in the saddle; they ride large, powerful horses, and both sexes are skilful riders. They are great sportsmen, and kill large quantities of game, chiefly wild horses, sheep, and antelope. They either employ firearms, or kill their prey with swords and spear when caught in a trap. Their capacity for eating meat appears to be unbounded, and they are apparently naturally somewhat bloodthirsty; as the Pundit states that on several occasions when an animal had been killed, he saw the Khámpa boys kneel down and lick the blood off the ground. This fondness for blood would appear to be derived from a still earlier age, as the food given to infants, when their mothers can no longer support them, consists, in the entire absence of grain in the country, of pounded cheese mixed up with butter and blood. They are of the Buddhist religion; but their language is quite different from that of other Tibetans, and only one man of the Pundit's party, who had resided some years at Sining-fu (to the east of the Koko-Nur) was able to understand it, and to make himself understood.

Between Gargethol and the Champa district of Shankhor on the south is a place called Gegha, where a large fair is annually held in July and August.

On the 29th of August the Pundit returned to Hissik Châka, where he saw a large herd of *kiángs*, wild horses, fully 200 in number. He continued his route over uninhabited level plains, till the 1st of September, when, at a camp called Humacho, he met on the road the Gombo of Garchethol, a gentleman who was distinguishable from his followers in that he wore a pair of golden earrings of such length as to rest on his shoulders. The presentation of the letter of introduction from their medical friend at Gargethol secured our party a civil reception.

The following night there was a sharp frost, the first sign of the approach of winter.

On the 3rd of September they reached the village of Mango, the head-quarters of the Gombo, who had gone on ahead of the travellers. The Pundit paid him a formal visit in his tent—a large one made of yák's hair—and made him a small present of sandal-wood. The Pundit was kindly treated, and on intimating to the Gombo that he was on his way to visit a celebrated monastery near the Namcho Lake, Chiring Dunduk (the Gombo), said he was himself about to move his camp several days' march in that direction, and proposed that they should perform the journey together. The Pundit gratefully acquiesced.

Among other visitors was an old man named Sonám Darka, about eighty years of age, a native of a country near Lhása, who had been living as a servant amongst the Khámpas for several years, and had gradually accumulated a good deal of property. The Pundit, when he found that this man could speak good Tibetan, succeeded in securing his friendship by the present of a couple of common sewing-needles, and obtained from him the following information about the neighbouring countries:—

Sonám Darka had on one occasion, some thirty years ago, made a journey from Thok Daurákpa to Ájan, a country about two months' journey in a north-easterly direction. The road lay throughout over an extensive plain, no large mountains being seen, or streams encountered *en route*. Drinking-water was obtained from a succession of small fresh-water lakes, mostly supplied from rain-water. Shortly before reaching the Ájan country, the road traverses a bare rocky range of mountains. Ájan itself was inhabited by the Sokpo Kalmucks, a nomadic pastoral people who obtained grain (rice and flour) from the neighbourhood of Karka, a large monastery said to be ten or twelve days' journey beyond the southern frontier of the Ájan country. Near Karka is a large city called Kokod, the residence of the ruler of the Sokpo districts, while Karka itself contains several monasteries, one of which is the residence of the spiritual head of the Sokpo Kalmucks. The road just described is never now made use of, on account of the difficulty of ensuring a certain supply of water *en route;* no one would venture to travel by it unless after an unusually heavy rainy season. Wood and grass are said to be plentiful throughout.

Karka is a name about which I have for some time past been endeavouring to obtain authentic information, but I can hardly venture to claim any great success in the attempt. It is first mentioned, as far as I am aware, by Major Montgomerie, R.E., in his discussion of the work of the Pundit, who explored the Namcho Lake in 1872. On the present occasion the Pundit had been specially instructed to make inquiries about it. He saw in Lhása some men who were pointed out to him as from Karka, tall, copper-complexioned, fine-looking men, but, unfortunately, he could not understand their language, and his stay in Lhása was so short that he was unable to learn anything authentic about them.

As far as I can gather from inquiries made at Yárkand, and from information collected by the Pundits, Karka is situated about one and a half month's journey to the north-west of Nák Chu Kha, a large village situated on a river of the same name a few marches to the north-east of the Tengri-Nur or Namcho Lake. At this village it is said that two roads diverge; one to Karka, passing in a north-westerly direction, and the other to Koko-Nur and Pekin in a north-easterly direction. The position of Karka thus obtained would agree approximately with an account I heard from a Kalmuck in Kashghár, which located Karka at about a fortnight's journey to the south-east of Lake Lob. It probably lies somewhere between Lakes Lob and Koko-Nur, and I think it not improbable that the country of Ájan to the south of it may be the same as the country of Anj Si which is mentioned by *Uspenski* in the Russian *Investigia* as a country lying in a westerly direction from the 'Zaidan Plain, which is to the west of Koko-Nur.

On the 4th of September the Pundit left Mango, in company with Sonám Darka, and the Gombo Chiring Dunduk, the headman of Garché, together with their flocks and herds; there were about six tents of Nomads in all. For four days they kept company, advancing slowly at the rate of about 8 miles a day. It is the habit of these people, when they have exhausted the pasturage near any one camp, to shift bodily to fresh ground; they were now on one of their customary moves. On the fourth day they reached Kezing, in the neighbourhood of which place are very extensive pastures, sufficient for the subsistence of the Gombo's large flocks for a couple of months.

Some idea of the wealth of this people may be inferred from the fact that one of the headmen was himself the fortunate proprietor of 50 horses, 400 yáks, and 2000 sheep. Other members of his tribe were said to be even more wealthy than he.

These Garché Khámpas, numbering in all about 100 tents, had only been settled in the country for about fourteen years. They are under the jurisdiction of the Gyalpo of Lhása, and are very much better off than their neighbours the Gargé Khámpas (who are under Rudokh), as they only pay what must be to them an almost nominal tribute (in gold) of the value of about 20*l.* This gold is obtained at Thok Daurákpa, to the east of Garchethol, in exchange for the produce of their flocks, and for borax, extensive fields of which exist at Noring Cho, which were passed by the Pundit *en route* to Kezing.

The Pundit appears to have ingratiated himself most successfully with the Gombo Chiring, for that chief very kindly made arrangements that he should travel onwards with two other men, servants of a merchant from the neighbourhood of Shigátzé, who were travelling with some spare yáks in advance of their master from Thok Jálung to Shigátzé. These men, for their own sakes, were only too happy to travel in company with the Pundit and his party.

From Kezing eastward for a distance of 80 miles, up to Thok Daurákpa, the country was uninhabited when the Pundit passed through it; but it is occupied by the Khámpas of Garché at certain seasons of the year. There is capital grazing and an abundant supply of water and fuel (argols) throughout. The road lies the whole way in one of the broad open *sangs* before described, lying between ranges of hills running east and west. South of the Tashi Bhup Cho, the southern range runs off in a south-east direction, rising rapidly in height and forming a massive group of snow-covered peaks, the positions of several of which were fixed by the Pundit, although at a distance of from thirty to forty miles south of his road.

From this snowy group flows northwards a very considerable stream, the Shyal-chu, which was crossed by the Pundit in three separate branches, which, although nowhere more than a foot in in depth, are said to be passable only with very great difficulty during the floods caused by the melting of the snow in the summer months. This stream flows into the Tashi Bhup Lake, whose southern shore is about two miles to the north of the Pundit's road. From the eastern end of the lake a stream issues, whose waters are said ultimately to drain into the Chargot Lake, from which they emerge under the name of the Nák-chu-khá River, and flow eastward to the village of the same name which lies on the northern road between Lhása and Pekin. At the point where the Shyal-chu was passed by the Pundit, his road was crossed by another track going from Manasarowar to Nák-chu-khá, which passes south of Tashi Bhup Lake, and then follows throughout its course the stream which emerges from the east end of the lake and flows to the Chargot Lake and Nák-chu-khá. This road is said to be perfectly easy and to abound with grass and water, but the country it passes through is uninhabited throughout.

The Pundit, who had been forewarned that the neighbourhood of the crossing of the two lines of road was a notorious place for robbers, took the precaution of pitching his camp 2 miles off the road. It is said that the custom of the Khámpa robbers who infest this country is to cut at night the ropes supporting the tent of the traveller, whom they fall upon and cut down while attempting to escape from the folds of his tent.

While under the immediate protection of the Gombo Chiring the Pundit had felt pretty safe, but he appears, not without good reason, to have passed several sleepless nights before he again reached inhabited country.

Travelling as a Láma, he had affected great poverty, and throughout the journey he kept his rupees concealed here and there in the most out-of-the-way places imaginable. His chief repository was a very old and ragged pad carried on the back of a donkey that had accompanied him from the West, and which animal, in consequence of the riches he bore, obtained amongst our travellers the *soubriquet* of *Sarkári Khizánchi*, or Government Treasurer.

The Pundit reached the gold-fields at Thok Daurákpa on the 17th of September, having taken on the latter part of the journey a somewhat difficult road over hills in order to avoid the easier road to the south, which passes round the foot of the hills, but where he thought he was more likely to meet with robbers. He had now quitted the Khámpa country and had entered the Nákcháng Pontod district, in which he passed two or three abandoned gold-mines before reaching Thok Daurákpa.

The Pundit only halted one day at the gold-fields, and continued his journey on the 19th of September. His route lay over precisely the same kind of country that he had previously traversed: it crossed several streams, all flowing to the north. For the first three marches the country was uninhabited; but after leaving Lhung Nakdo, numbers of Chángpa tents were almost daily seen from the line of march.

Although the plain he was now traversing was more than

16,000 feet above the level of the sea, the Pundit does not appear to have suffered very much from the great elevation; the weather was mild, and he speaks of the whole of the journey over the plains of Tibet as a delightful pleasure excursion, when compared with his experiences over the Karakorum and other passes on the road from Leh to Yárkand. The sheets of velvet turf, covered with countless herds of antelope, must, indeed, have formed a pleasant contrast after the equally elevated, but bleak and uninhabited, bare plains of Ling zi Thang and Dipsang, in Northern Ladákh. The Pundit (who is fond of statistics) asserts that on one occasion he actually counted 2000 antelopes (*cho* and *gwa*), which resembled in appearance a regiment of soldiers, with their horns glistening in the sun like bayonets. The horns frequently found lying on the ground served him in lieu of tent-pegs.

In the Nákcháng Ponted (Northern and Southern) district, which extends for several marches east of Thok Daurákpa, there are altogether about 150 families of Nomads, all wealthy in horses, yáks, sheep, and goats. Throughout Nákcháng the sheep are very large and strong, and are almost all black—a peculiarity of this district alone, those in Western Tibet and Lhása being nearly all white. Yáks are used almost exclusively as beasts of burden, and on one occasion the Pundit met a caravan with two hundred of these animals carrying tea towards the west.

The Changpas of Nákcháng, who are also promiscuously termed *Horpas* and *Dogpas*, speak a language which differs but little from that of Lhása, and the Pundit had no difficulty in carrying on conversation with them.

In the eighth march from Thok Daurákpa, the Pundit encountered a lofty range of mountains, which was crossed by a high but easy pass, called Kilong, 18,170 feet above sea-level. This range runs southward, and culminates in some enormous peaks known by the name of Tárgot Lhá, from which extends eastwards a snowy range, numerous peaks in which were fixed by the Pundit, along a length of 180 miles, up to where the range terminates in a mass of peaks called Gyákharma, which also lie to the south of and very near the Pundit's road. The highest of these Gyákharma peaks was ascertained by measurement to be 22,800 feet above sea-level, and the Pundit estimates that the highest of the Tárgot peaks (which lay too far off the road for vertical measurement with a sextant) is at least 2500 feet higher than the highest of the Gyákharma group. Tárgot Lhá was seen from the Chapta Pass at a distance of over 100 miles, and is believed by the Pundit to have been the highest mountain seen by him on his journey.

The highest peak of the Tárgot Lhá group is called Tárgot *Yap* (or father), while an enormous lake, which lies at the foot of its northern slope, is called Dángrá *Yum* (or mother); these two, according to local tradition, are the progenitors of the whole world. The circuit round the mountain and lake combined is a common pilgrimage, not only for the people of the Hor country, but for their more distinguished co-religionists from Lhása. Similar circuits are made round the sacred mountain of Kailás, near the Manasarowar Lake.

The circuit round the lake alone occupies from eight to twelve days, the distance being about 200 miles; but the complete circuit of lake and mountain takes up nearly a month. The country people believe that if they make the complete circuit (termed locally *kora*) once, they will be absolved from ordinary sin; for a man to be cleansed from murder requires two *koras;* but if the round is completed thrice, even the murder of a father or mother will be atoned for. The Pundit did not feel much comforted on learning that this is all implicitly believed by the country people.

The district surrounding the Dángrá Lake and another smaller lake, to the north of the road, is called Nákcháng Ombo. It is surrounded on all four sides by snowy mountains, and contains several villages. Each village contains twenty or thirty houses, built of stone, and surrounded by richly-cultivated fields, which produce a profusion of barley. The harvest was not quite gathered in on the 28th of September, the date of the Pundit's arrival.

The existence of this cultivated Ombo plain enclosed by mountains, which in their turn are surrounded by boundless extents of pasture-land, is a very curious feature.

The Pundit had not seen a single field of grain of any description since leaving Chabuk Zinga, thirty-five marches to the west, nor did he again meet with cultivation until reaching Tulung village, near Lhása, thirty-nine marches beyond Ombo. The height of the plain (15,240 feet above sea-level) is not less than that of the surrounding country, and, although somewhat protected from wind, it is no better off in this respect than the district of Nákcháng Gomnak, which borders it on the east, which is also well watered, and has apparently a richer soil, but is, nevertheless, totally devoid of cultivation.

The Pundit is of opinion that the Dángrá Yum Cho and the smaller lake of Táng Jung, to the north, were formerly connected together in one vast expanse of water. The Dángrá Lake is even now so large, and the wind sometimes raises such violent waves, that the Pundit compares it to the ocean.

Thus far on the journey, the Pundit states that a cart might be driven all the way from Noh, without any repairs being made to the road; but in crossing the range, which bounds on the east the Pembo country, the path was steep and difficult. There is an alternative road, however, lying to the north, by which it is said a cart (supposing there to be such a thing in the country) might easily travel from Thok Daurákpa to the Namcho Lake without meeting a single obstacle *en route.*

The country to the east of the Pembo district is of a precisely similar nature to what the Pundit had already passed through on the west. It is inhabited, as far as the Namcho Lake, by pastoral Changpa Nomads, who live mostly on the produce of their flocks and herds. No grain whatever is grown, but large quantities are imported from the Shigâtzé and Lhása districts to the south. The inhabitants are well off, as, in addition to the produce of their flocks, they sell to the merchants of the south large quantities of salt, which is obtained from numerous *chákás*, or salt-lakes, which lie at from eight to twelve days' journey to the north of the Pundit's road.

The height of the plateau traversed appears to vary but little between 15,000 and 16,000 feet above the sea-level. The plain is, as a rule, confined between mountains which run parallel to the direction of the road, but a few transverse ridges of considerable elevation are crossed *en route.* The drainage all tends to the north, the streams from the snowy range to the south finding their way into numerous large lakes, which either lie in the *sangs* traversed by the Pundit, or are enclosed in similar *sangs* to the north. These lakes are the characteristic features of the country, and the Pundit may well be proud of the discovery and survey of such a numerous and extensive system. Of the whole series extending from Noh to Lhása, and stretching across both sheets of the map, the only one that has hitherto been known to geographers is the Nam Cho, or Tengri-Nur Lake, to the extreme east, which, although its position with regard to Lhása was approximately known, and was marked on the old Chinese maps, yet it is only within the last few years that its position and extent have been determined with anything like accuracy. This was done by another Pundit, a pupil of the veteran explorer, whose discoveries are now given to the public.

The largest of these newly-discovered lakes, the Dángrá Yum Cho, is about 45 miles in length, by 25 in breadth, at its widest part; another large lake, the Kyáring Cho, is 40 miles in length, and from 8 to 12 across. The waters of the former are slightly brackish; but those of the Kyáring Cho, and nearly all the lakes to the east, are beautifully fresh, and, as well as the streams which feed them from the south, contain abundance of fish, and are covered by myriads of wild-fowl.

On the occasion of the former exploration of the Namcho Lake it was frozen over, and although the Pundit made the complete circuit of the lake he was unable to discover any stream flowing from it. On the present occasion, however, our Pundit, having visited it in the autumn, before its waters were frozen, distinctly traced a stream issuing from its north-western extremity and flowing in a westerly direction. Although, at the time he saw it, the stream was not more than a few feet in width, the water-course was broad and deep, and in the summer months must give exit to a large river.

The largest river crossed by the Pundit in this section of his travels was the Dumphu, or Hotá Sangpo, which receives the drainage of the southern slopes of the Tárgot-Gyákharma range of mountains, and flows into the Kyáring Cho, forming one of the numerous sources of the Nák-chu-khá.

The subsequent course of this last river, of which some of the head-waters have now been traced, must, I fear, remain a mystery. The account which was given by the Pundit is inconsistent with the existing ideas of the geography of the country. It is to the effect that after passing the village of Nák-chu-khá (Na Ptchu of the Abbé Huc), which is on the road between Lhása and the Koko-Nur Lake, the river flows in a south-east direction to Chámdo, or Tsiamdo, a well-known place on the road from Lhása to Bathang (Pá) and Pekin. Thence it is said to flow south-east and east through Ámdú to China, under the names of Máchu and Konkong. If this statement were reliable it would prove the Nák-chu-khá to be a branch of the famous Yang-tsze-Kiang; but, after a very careful examination of the whole of the data, Captain Trotter came to the conclusion that the evidence in its favour is not sufficiently strong to justify his entering into the subject at length.

It appears, on the whole, not improbable that the first part of the Pundit's statement may be correct, viz. that the Nák-chu-khá River flows to Tsiamdo; if so, it bears successively the names of La-chu, Lo-chu, and Lanthsang-Kiang, which, according to most modern authorities, is afterwards known as the Kamboja, or Mekhong River.

If, however, Klaproth's well-known map is to be relied on (but we know that in one important instance at least, viz. the identity of the great river south of Lhása with the Irawaddy, modern geographers entirely disagree with him), the Nák-chu-khá does not flow to Tsiamdo, but forms the head-waters of the Nou or Lou Kiáng, which modern geographers identify with the Salween River, which empties itself into the ocean at Moulmein.

The Pundit took the same route along the northern shore of the Námcho Lake which was followed by his predecessor in 1872, and was described by Major Montgomerie in the Survey Reports for 1873-4. From the east end of the lake to Lhása the routes are identical down to the village of Dam. From Dam, Nain Singh followed the river of the same name in a south-west direction, instead of striking across the hills to the south-east, the direct route which was followed by the other Pundit.

It was not till the 12th of November that the Pundit quitted the higher table-lands of Tibet, and after crossing the Baknak Pass, 18,000 feet above sea-level, descended into the bed of the Tulung, an affluent of the river of Lhása, where for the first time for several months he found himself at the comparatively low elevation of 13,000 feet, from which a steady descent for five short marches brought him to Lhása, at an elevation of 11,910 feet. His pleasure was great on reaching Tulung Valley, where he found cultivated fields replacing pastures, and grain in abundance, vegetables, chang, and other luxuries to which he had long been a stranger. Ordinary cattle and donkeys now took the place of yáks as milk suppliers and beasts of burden. Fowls and pigs were seen for the first time since leaving Ladákh. The more civilised Bodhpas replaced the Changpas, and the Pundit was looking forward to a pleasant stay in Lhása.

But, unfortunately for him, the approach of civilisation brought him considerable anxiety. On nearing Lhása he heard a report that it was currently stated there that an English agent was on his way there from India, and that a *boná fide* Chinaman, who had recently arrived from India *viá* Nepál, had been arrested and kept in confinement until an interview with the Chinese Ambán had enabled him to prove that he was not the man they were in search of.

The Pundit, on hearing this, halted a day at Lang-dong, and sent one of his own servants (Nendak, a native of Lhása) on ahead to engage a room in a traveller's serai, and to inquire whether any news had been received of the caravan from Leh. The man returned, and reported that nothing had been heard of it; the following day (the 18th of November) the Pundit entered Lhása.

On the occasion of the Pundit's first visit to Lhása he remained there three months, and wrote a good description of the place. His present hasty visit of two days only has not added to our existing store of information. He left it on the 20th of November, accompanied by his two servants. Prior to starting, he collected the most bulky and least valuable articles of his property, tied them up in an old blanket, carefully sealed the parcel, and handed it over to the owner of his lodging-house, whom he informed that he was going on a pilgrimage to a monastery ten days' journey to the north of Lhása, whence he expected to be back in about a month to reclaim his goods. He started accordingly in the afternoon in a northerly direction, but, as soon as evening came on, he wheeled round, and commenced his return journey to Hindústán.

The first night he halted at Kombo Thang, only 2 miles out of Lhása; the following day he reached Dhejen, a flourishing town, with a large monastery on the left bank of the Lhása River. His route for the first stage was along the high road to Pekin.

From Lhása to Pekin there are two roads; the one generally used, and which is believed to be open all the year round, goes at first nearly due east from Lhása to Tsiamdo, the capital of the Kham country; it then takes a southerly direction, and passes through Pá or Bathang, and the Chinese province of Sze-chuen, crossing *en route* numerous snow-covered passes across the ranges which divide the streams which rise in Tibet, and flow southwards either into the sea or into the great Kin-sha-Kiang, afterwards the Yang-tsze-Kiang. From Lhása to Pekin by this route is 136 caravan-marches, and the distance about 2500 miles.

The other or northern route, which is generally preferred by travellers in the hot season, is probably easier, and there is much less snow encountered *en route*. It goes by Nák-chu-khá, and crosses the head-waters of the Yang-tsze-Kiang, from which there are two alternative roads to the Koko-Nur. Thence the road passes by Sining-fu (Silling) to Pekin. It was followed by the Abbé Huc in his journey to Lhása.

At Dhejen the Pundit quitted the Pekin road, and, turning south, crossed by the Gokhar Pass (16,620 feet) the range that separates the Lhása River from the Brahmapútra. The pass was covered with fresh snow. From it he obtained a very extensive view, embracing the Yalá Shimbo snowy peaks 60 miles to the south-east, and the Ninjen Thang Lá peaks at a still greater distance on the north-west.

On the 27th of November he reached the Sama-yé Monastery, which lies on the right bank of a small tributary of the Brahmapútra, about 2 miles before it falls into the great river.

From Sama-yé the Pundit travelled down the course of the Brahmapútra for two marches, passing several small tributaries *en* *route.* He crossed the great river in a boat on the 30th of November. In this portion of its course it is known either as "Tsanpo" or "the river," or by the name of Támjun Khá. At this, now the lowest known part of the course of the Brahmapútra in Great Tibet, the Pundit estimates the width of the river at 500 yards. The stream was very sluggish, its current near the banks being no more than two-thirds of a mile per hour. Its depth was nowhere more than 20 feet.

The valley through which the river flows was here several miles across; on the left bank of the stream was a stretch of sand fully 1½ mile in breadth, the whole of which is said to be under water in the months of May, June, and July; during which season the river is much flooded, both on account of the increase of water from the then rapidly melting snows, as well as from the rain, which falls in considerable quantities from April to June. The river is here no longer used for irrigation, as above Shigátzé, but all the smaller streams which issue from the mountains on the north and south are thickly bordered with cultivated land.

The Pundit left the river near Chetang, from which point he states that its general course is visible due east for a distance of 30 miles, after which it encounters a range of mountains which cause it to diverge in a south-easterly direction. By taking bearings to, and fixing the position of some peaks on this side of which the river is said to flow, he fixed the course of the river approximately for a very considerable distance below where he quitted it. The course of the river thus determined is very fairly accordant with that shown on Du Halde's map of Thibet.

The Pundit has thus been able to throw a little more light on the lower course of the Tsanpo, or the Great River of Tibet. It is unnecessary to follow Wilcox, Montgomerie, and others, who appear to have clearly proved that the Tsanpo must be the large river which, under the name of Dihong, enters Assam near Sudiya, where it is joined by the Brahma-kúnd. We may safely admit that this is the case; and although the name Brahmapútra is doubtless derived from the Brahma-kúnd of the Assam Valley, geographers have, in consideration of the wide-known celebrity of the name Brahmapútra, bestowed it on the Tsanpo, the upper and most important source of the great river.

From Chetang the Pundit's road lay up the Yálung, through a rich and fertile valley, which contains numerous villages and monasteries scattered about on both sides of the stream. The country is very productive, and contains numerous fruit-trees, principally apricots and pears; wheat and barley are abundant, as well as peas, and many other kinds of vegetables. There is good grazing on the mountains which border the valley, but the breed of sheep is very small.

From Chetang to the Dálátang plain at the head of the valley is 36 miles. In addition to numerous scattered villages of 10 or 12 houses each the large towns of Naitong and Chukyá Bhutáng are passed *en route*. From the Dálátang Lá to the Karkang Lá the road traverses for 15 miles a grassy plateau, between 15,000 and 16,000 feet above sea-level, through which flows a stream which takes its rise in springs, and ultimately finds its way into the Brahmapútra below Chetang. On this elevated region, which extends from a considerable distance to the west, the Pundit again found himself among the Dogpas, or Nomad population. It is by the Karkang Pass to the south of the plain that the main Himalayan watershed is crossed. On reaching it the Pundit states that a magnificent view presented itself. The whole of the foreground was occupied by gently undulating grassy plains, over which on the north-west, at a distance of but a few miles, rise the very conspicuous group of snowy peaks called Yála Shimba. Other snowy peaks beyond the Brahmapútra appeared topping the plateau to the north, while east and west and south, snowy peaks rose in every direction, but at great distances off.

From the watershed, which is 16,210 feet above sea-level, the road to the Kyá Kyá Lá, a pass about seventy miles further south, traverses a high undulating plateau, which is bounded on its west by a well-marked snowy ridge, which runs nearly due north and south, and contains numerous glaciers. The drainage of this country is most irregular. The Pundit's road for the first 20 miles from the pass followed a stream which, under the name of Sikung Sángpo, flows for 40 miles nearly due east, through the Chahuil country, and ultimately turning south-east, runs nearly parallel to the upper course of the Brahmapútra, which river it is said to join in Assam. After leaving the main stream, the road ascends a branch valley for a distance of 20 miles to the Serása Pass (15,300 feet), and thence descends into a stream which flows due south for 40 miles, and subsequently, under the name of Táwáng-chu, takes a westerly course, and flows round the southern extremity of the southern range which has been mentioned as bounding the plateau on the west.

That portion of the plateau which contains the head-waters of the Sikung River is from 13,000 to 15,000 feet above sea-level. It is a very flourishing, well-cultivated country, covered with numerous small villages containing settled inhabitants.

The road itself, after leaving the Serása Lá, goes nearly due south, crossing in succession several spurs from the western range, and after reaching the Kyá Kyá Pass, rapidly descends into the Chukhang Valley, which is separated from that of the Táwáng by a very high ridge which is crossed by the Mila Khatong, a pass which was covered with fresh snow.

Between the Sikung district and Chona Jung the country is uninhabited.

Chona Jung is a place of considerable importance, and is a great exchange-mart where salt, wool, and borax from the Hor country, and tea, fine silks, woollen cloths, leathern boots, and ponies from Lhása, are exchanged for rice, spices, dyes, fruits, and coarse cloths from Assam. This market must be one of considerable importance, and contains 300 or 400 shops. The Pundit is of opinion that although the import and export trade is not nearly so valuable as that at Leh (the great exchange mart for India and Eastern Turkistán), yet that the number of traders and animals and men employed in carrying loads is somewhat larger. The merchants who import the articles from Assam are mostly natives of Táwáng, who are called Monhpas; but the goods imported from Hor are brought in by the Dogpas or Changpas. The goods from Lhása are brought by merchants from that place. The road from Chona Jung to Táwáng Chukhang is closed by snow from January to May or June.

The Pundit reached Táwáng on the 24th of December, and was detained there till the 17th of February, having been unable to get permission to proceed to the south.

Leaving Táwáng on the 17th of February, the Pundit reached Odálguri, in British territory, on the 1st of March, the road being often deep in snow, while four passes had to be crossed *en route*; of these the passage of the Sai Lá and the Menda Lá were somewhat difficult on account of snow.

At Odálguri the Pundit put himself in communication with the Assistant-Commissioner of the Darrang District, who kindly made all the necessary arrangements for forwarding him to Gauháti, whence he went by steamer to Calcutta, which place he reached on the 11th of March, 1875.

Before closing this Paper it may be well to recapitulate the chief results of the Pundit's last exploration.

He has made a very careful and well-executed route-survey of the whole line of country traversed. viz. 1013 miles from Lukong (west end of Pankong Lake) to Lhása, and 306 miles from Lhása to Odálguri. Of this total distance of 1319 miles, throughout which his pacings and bearings were carefully recorded, about 1200 miles lie through country which has never previously been explored. Numerous lakes, some of enormous size, and some rivers have been discovered; the existence of a vast snowy range, lying parallel to and north of the Brahmapútra River, has been clearly demonstrated, and the positions of several of its peaks have been laid down, and their heights approximately determined.

The Brahmapútra has been followed for a distance of 30 miles in a portion of its course, 50 miles lower down than the lowest point hitherto determined; and as its approximate course for another 100 miles has been laid down, the absolutely unknown portion of that mighty river's course now remaining has been very materially reduced. The route between Lhása and Assam, *viá* Táwáng, of which next to nothing has hitherto been known, has been carefully surveyed, and the daily marches described.

As a framework for the map, no less than 276 double altitudes of the sun and stars have been observed with a sextant for the determination of latitude, and the close accordance of the results *inter se* and with the mapping of the route, by the pacings and bearings, prove incontestably the general accuracy of the work.

The temperature of boiling water has been observed on nearly every pass and nearly every camping-ground (497 observations in all), adding materially to the value of the maps.

Frequent observations of the temperature of the air and the direction of the wind have given us some further addition to the knowledge of the Tibetan climate.

The Pundit suffered much in health during the latter portion of the journey, and his eyesight has become seriously injured from exposure and hard work, in most trying climates, throughout a long series of years. He is now anxious to retire from active work, and will probably receive a grant of land in his native country; and thus, having happily survived the perils and dangers of the road, it is hoped he may spend the declining years of his life in comfort, and with a due appreciation of the liberality of the British Government.

[The above Paper will be printed entire in the 'Journal,' vol. xlvii.]

The PRESIDENT was sure all present must have felt that the journeys of Nain Singh were of the greatest interest. He had filled up a great blank in the map of Thibet, and had discovered numerous lakes and rivers which were formerly unknown. His last journey was of special interest at the present time, because the English Minister at Pekin, in his recent convention with China, had stipulated that there should be a right of travel from China across Thibet into India, opening up the very route which Nain Singh had traversed. Every part of Central Asia was becoming daily of more interest, politically, and even commercially. Such journeys as that which the Pundit had accomplished, however, were full of peril and wasteful of human life, and therefore the Pundit was entitled to great praise. He had undertaken two journeys each extending over 1200 miles. The last was across the great northern plateau of Thibet. By far the most interesting account of any journey previously made in the present generation in that country, was that written by the Abbé Huc, and his brother missionary, the Abbé Gabet. The Abbé Gabet died very soon after his return home; and though Abbé Huc lived to write a brilliant book, and was very much fêted and appreciated in his own country, France, he died a very few years after. There was no doubt that the health and constitution of both were ruined by the trials which they experienced in traversing the Thibetan plateau from 15,000 feet to 16,000 feet above the level of the sea. The Society were much indebted to Captain Trotter for giving them an account of the journeys of the native explorers beyond the Himalayas.

Colonel H. Yule said, although he had not himself been in Thibet, in that respect he was in a similar position to every one present. Some few Europeans might have got, as it were, upon the margin of the region, but in the course of many centuries very few had actually entered on the great plateau. If only the journey of the Pundit from Ladak to Lhása, which had just been described, was considered, it might seem that the results were not of the highest importance; but the labours of Nain Singh must be taken as a whole. This was not his first journey. In 1865–6 he made another and a more important journey of about the same length, when he visited Lhása, and traced nearly the whole course of the great river which was generally identified with the Brahmapútra. Thibet was a most interesting country in many respects. If the sea were supposed to rise until it attained some 13,000 feet above its present level, nearly the whole of Asia would disappear, and so would Arabia, Persia, India, and China, leaving the large tract which was called Thibet. That would remain above the surface. There was no other such extensive area in the world of such an elevation. A region extending over 300,000 or 400,000 square miles might be found in Thibet never descending below the level of the top of Mont Blanc. That was one remarkable circumstance about Thibet. Thibet must really be considered to begin immediately north of Cashmere, and to extend to the Chinese frontier at Sining-fu. Over all that country substantially the same language was spoken, and, with one exception, it was of one religion, that of Lama Buddhism. The only exception was to the extreme west, where in the country which was known as Little Thibet the people had for some centuries been Mahometans. The accurate geography of this country might be said to have begun in the year 1710 or 1712, when the Jesuit Missionaries were engaged in making their great survey of China. They were not themselves able to enter Thibet, but they partially trained some Lamas, very much as Colonel Montgomerie had trained the Pundit, and these Lamas made a kind of survey, giving in a general way the course of a good many rivers, which were afterwards mapped by d'Anville in his great atlas of China. Until lately that had been the foundation for our knowledge of Thibet. It was not, however, known what value to attach to a good many of their points, and a great deal of their description was obviously very vague and general. The Pundit Nain Singh was the first who had given accuracy and substance to the map of Thibet. He had fixed the position of Lhása, and of the great river, and carried a diagonal from Ladak to Lhása. Though Thibet had been entered at various times by European travellers, unfortunately none of them were geographers or surveyors. About the year 1660 or 1670, two Jesuit priests, Grueber and d'Orville, travelled from Sining to Lhassa, then to Kathmandu, and into India; but the account of their journey was very meagre, and they took no observations. Afterwards an Italian priest, Ipolito Desideri, entered Cashmere and travelled from Ladak to Lhása —possibly by the very route which the Pundit had described, but his journal had only recently been recovered in Italy, and had not yet been published. In the last century a Dutchman, Vanderput, travelled from India through Lhása to China, and back again the same way, but had left hardly any record of his journey, and that little would have been totally unknown but for the exertions of Mr. Markham when compiling his book on Thibet. The next journey was by Bogle to the north of the Tsanpo; and 40 years later, Mr. Manning reached Thibet. Why he went there it was difficult to understand, even from his own journal; but he did get there, and was arrested, and sent back again. The next account was that of Huc and Gabet. They also were not geographers, and they added almost nothing to the geographical knowledge of the regions, though the book which the Abbé Huc published was one of the most entertaining that ever was written. It therefore remained for the Pundit Nain Singh to give an accurate basis for the maps of Thibet. That was the great achievement which he had accomplished with very much toil, and with the sacrifice of his own health, and which was the great reason why the Geographical Society had awarded him their Gold Medal.

Sir HENRY RAWLINSON said he was particularly glad to attend on the present occasion, because, independently of the interest which in common with all geographers he took in the discovery of previously unknown tracks of Central Asia, he had a personal interest in the Pundit's journeys. Ten years ago, when Colonel Montgomerie brought the first journey of the Pundit before the notice of the Society, he was the means of obtaining from the Council of the Geographical Society the presentation of a gold watch to the Pundit in recognition of his valuable services to the cause of Geography. He had therefore always felt that he was to a certain degree sponsor for the Pundit in his geographical work. On referring to the 'Proceedings' of the Geographical Society of that date, he was particularly struck by a remark of the late President, Sir Roderick Murchison, who, with that wonderful prescience which distinguished him on so many occasions, in presenting the gold watch to the Pundit, said that he felt pretty sure that that was only an earnest of further distinction, in fact, he unmistakably alluded to the probable presentation to the Pundit of the Gold Medal of the Society on some future occasion. From that time to the present he had always followed the Pundit's work with deep and ever-increasing interest, and he was delighted to find that his career had now culminated in his carrying off the Blue Ribbon of Geographical science—the Gold Medal of the Royal Geographical Society. But while he gave every possible credit to thePundit for his perseverance, his gallantry, and his skill, he could not forget the claims to consideration of the Department of the public service which founded the school to which the Pundit belonged. It was found to be a crying want in the geographical researches of India that Europeans were unable to penetrate into those countries which lay on the north and north-western frontier, and it occurred to the heads of the Department of the Trigonometrical Survey that it would be desirable to found a school for the purpose of promoting discovery by native agents. It was a very difficult task to commence with, but by degrees the Department succeeded in training both Mahometans and Hindoos for the purpose of exploration; and he had always felt that great credit was due to those officers, especially to Colonel Walker, the head of the Trigonometrical Survey; Colonel Montgomerie, who really founded the school of native explorers; and Captain Trotter, who not only completed the work of his predecessors, but also utilised the results which they had obtained. Such men as the Pundit, the Havildar, and the Mirza, were invaluable in traversing unknown countries, where Europeans were unable to show their faces. They collected facts, recorded distances, and made observations for altitude and latitude. None of them had, however, as yet been able to determine a longitude. The taking of a lunar appeared to be beyond the power of any native surveyor. The longitudes had been arrived at by cross routes and dead reckonings, so that the position of Lhása had not yet been scientifically ascertained. The latitude was determined by the Pundit on his former visit in 1865, when he spent three months there. Great credit was due to the officers who had sent out these native explorers, and on their return had tabulated their observations and memoranda. He regretted the absence of Captain Trotter, who no doubt would have been most gratified to hear Colonel Yule's well-deserved eulogium on the Pundit's work, and the few words which he himself (Sir Henry Rawlinson) had expressed as to the services performed by the Trigonometrical Survey.

The PRESIDENT said he had hoped that Sir Douglas Forsyth would have been able to attend that evening, but a letter had been received from that gentleman stating that he was suffering from a serious cold, and could not be present. He had, however, written a few observations, pointing out that Nain Singh had been one of his own employés, and was engaged in carrying out a system of exploration which Captain Trotter designed.

"14th May, 1877.

"Though unfortunately I am unable to attend this Evening's Meeting of the Royal Geographical Society, I shall be glad to be allowed to convey through you some remarks on the labours of the distinguished Pundit, Nain Singh, an account of whose latest travels, I understand, is to be read instead of the Paper promised by Captain Trotter.

"A very interesting summary of the Pundit's proceedings was given in the 'Times' not long ago, from a perusal of which, the claims of this remarkable Indian surveyor to the high honour which has just been conferred on him by the Royal Geographical Society are made abundantly evident. Yet even in that statement the facts are in one instance only inadequately represented, and there is a not unimportant omission which I would in a few words supply.

"I allude to that part of the statement which says that the Pundit was attached to the Mission to Kashgar in 1873, but returned the same year, and no mention is made of the services rendered to that mission, either by himself or his brother Pundits, nor are the facts attendant on, or rather leading to, his undertaking the final journey which has proved the crowning point of his labours alluded to.

"The facts are as follows. When the Government of India decided to send a diplomatic mission to the Atalik Ghazee in 1873, it was determined to appoint an officer of the Indian Survey Department to accompany the Expedition as Geographer, and to give him an efficient staff of Assistants. Captain Trotter was the officer selected; and Abdul Subhan, a sub-surveyor in the Topographical Survey Department, and two of the great Trigonometrical Survey Pundits with their Assistants, were added; and so far from Pundit Nain Singh having returned the same year without doing anything, he remained with the Mission the whole time, and was despatched on his Lhása trip by Captain Trotter, after our return to Ladak in 1874.

"Of the invaluable service to science rendered by Captain Trotter, it is not necessary now to speak, as I hope some other opportunity may be afforded him of proving his claims on this Society. But as the Paper which has been read this evening, giving a record of Pundit Nain Singh's travels, was drawn up by Captain Trotter, and as the Pundit was deeply indebted to his English superior, at almost every step, for advice and instruction, it is only fair to Captain Trotter that those of us who had opportunities of observing his powers of organising the staff placed at his disposal should bear testimony to the evidence of good generalship thus displayed.

"The original plan for utilising these Assistants was to send the Mahommedan portion into the countries across the Pamir and the Alai—wherever, in fact, they would meet their co-religionists—and to send the Pundits by the northern route to Lake Lop, and thence to despatch them across the great Gobi Desert, through Thibet and Lhása to Hindostan. These plans had to be abandoned, and a less ambitious programme was carried out, in which Pundit Kishun Singh proved himself to be a worthy follower of the one whom we now delight to honour. I will tell immediately what Kishun Singh did, but will first dispose of Pundit Nain Singh. He remained during the severe part of the winter in Yarkund, and took valuable meteorological observations. As soon as the season for crossing the Pamir came round, Pundit Nain Singh was despatched from Yarkund to explore the Kogyar route to the Karakorum, and the report he sent back proving very favourable, we all returned to India by it.

"Pundit Kishun Singh's explorations were of a more extended character. Besides accompanying Captain Trotter in his expedition from Kashgar, he was taken by that officer on his Pamir Expedition, as far as Tash Kurgan, and despatched thence to Yarkund by the direct route, viz, the Charling River. He then was sent by Khoten and Polu, across the eastern continuation of the Kuen. Luen, and over the vast lofty plain to Lake Pangong and Leh. The survey of this route was pronounced by Captain Trotter to be one of the most important geographical results secured by the Mission. After detailing the Pundit's progress, Captain Trotter says, 'The newly acquired knowledge of this road may, perhaps, lead to important practical results . . . It is apparent, by combining the results of this survey with other information collected by the Survey Pundit during the past few years, that a road exists between the plains of Hindustan and Turkestan, which entirely avoids the territories of the Maharaja of Kashmir, and which in summer months may be traversed without once crossing snow, or without encountering one really difficult pass, such as are known to exist in the Kara Korum and Changchemno routes.' One result of Pundit Kishun Singh's route-survey was to cause an alteration of more than 30 miles in the previously accepted value of the longitude of Khotan.

"The success achieved by Kishun Singh in this journey across the range from Khoten to Leh, suggested, or at all events stimulated, the idea of sending Nain Singh on his long cherished journey of exploration through Thibet, and across the eastern end of the Himalayas to India, a trip which he has bravely accomplished.—T. DOUGLAS FORSYTH."

Mr. E. DELMAR MORGAN remarked, that although the Pundit's journey was no doubt a very interesting one in many ways, it was desirable that some European should visit the same regions, who would be able to collect facts relating to the animal and vegetable life there. Sir Henry Rawlinson had spoken of the difficulties to be overcome in such a journey, but when it was remembered what English explorers had done in the Himalayas, and what Russian explorers had done further to the north, among mountains as high and passes as difficult as those which the Pundit had visited, surely men could be found to explore the great plateau of Thibet. Colonel Yule had omitted to mention one explorer who had done good service in the northern part of Thibet, the Russian traveller Prejevalski.

Mr. TRELAWNEY SAUNDERS said, no one who had studied Himalayan geography could fail to feel grateful for the two vertical sections across the mountains down to the Tsanpo, by Pundit Nain Singh, one of which was described in the Paper. Those sections had thrown a general light on the whole subject. He was highly delighted to hear that the Society has awarded its medal to the Pundit. Nothing could be more encouraging to our fellow-subjects of low rank in India than such an appreciation of merit. He looked upon Thibet and its great flocks of sheep as a source of wealth, not only to that country, but to India and England, and a substitute for cotton, whenever the Americans themselves manufactured that cotton which now supplied the English looms. One point that the Pundit had settled beyond dispute was that of the distinction between Hor Pa, or High Land, and the Sok Pa. These were the two great ethnological divisions of the country; the Hor Pa being occupied by tribes of Turkish race, and the Sok Pa by Mongols, whose Sok or pastures gave them their name, and pointed to the origin of the ancient Scythians. While the region inhabited by the former was a high mountainous plateau drained by interior lakes, that occupied by the Sok Pa was intersected by the deep ravines of the affluents of the Brahmaputra, the Salween, the Cambodia, the Yang-tsze-Kiang, and the head-waters of the Hoang-ho. He was particularly delighted to hear that all this magnificent region was probably no longer to be hermetically sealed to European observation. Allusion was made in the Paper to Kalka, which had long been regarded as an inexplicable puzzle, and he hoped that when the Paper was printed in the 'Journal' it would be accompanied by an explanatory note on the subject of Kalka. Mr. Markham had elsewhere, and so had he himself, explained the problem. Karka was noticed by Turner. It was identical with Kalka, which was derived from the Kalka River of Northern Mongolia. That river gave its name to the Mongolian princes, who, when driven out of China, previous to the Manchu invasion, settled on the Kalka River, and so acquired the name of the Kalkas. Outer Mongolia is divided among the four Kalka Khanates to this day. The high priest or Taranath Lama of the Kalkas governed the priestly influence that controlled all Mongolia. Such was the importance attached to this high priest, that the Chinese Emperor found it necessary to take his election out of the hands of the Kalka princes and make it subordinate to the Grand Lama at Thibet. The Russians supported an armed mission at Urga, the seat of the Taranath Lama; and he hoped that we might look forward to some peaceful intercourse with Lhása, at no distant period.

Sir HENRY RAWLINSON said intelligence had recently been received that Colonel Prejevalski had reached Lob Nor, the lake in the great plain of Tartary, which had never before been visited by an educated European. He had travelled round it, and found that it was of greater extent than had previously been supposed. He had also discovered traces of several ruined cities on the southern and south-western shores, recalling those traditions of buried cities which Sir Douglas Forsyth had collected. Mr. Morgan asked why English officers were not able to perform journeys into Thibet. The physical difficulties of course could be overcome, but the exclusive policy of the Chinese had hitherto prevented any Englishmen from surveying the country. If the Chefoo convention was carried out, as it was hoped it would be, then no doubt there would be a little army of scientific explorers sent into Thibet, who would collect specimens of the fauna and flora, and exhaust the scientific examination of the country. The same political difficulties existed in some Mohammedan countries. No European had been allowed to trace the upper course of the Oxus, or the great route by the Chitral Valley from Peshawur.

The PRESIDENT said Lhása was the Mecca of the Buddhist world of Eastern Asia, and it was no more possible for a European to get to Lhása than to Mecca. It was true that Captain Burton had succeeded in reaching the latter city; but when Mehemet Ali once was asked by a well-known traveller for authority and an escort to go to Mecca, the reply was: "Yes, you can go to Mecca and you can have an escort; but you won't come back, you know, and I don't think many of your escort will return either." Geographers are indebted to Sir Thomas Wade, who has obtained the recognition of our rights as to travelling through this country under the "Favoured Nation" clause. No doubt it would be a long time before the advantage would be much utilised, for it was a very natural thing for the Chinese, whose power over the country was really dependent on the influence of the Lama at Lhása, to look, with the greatest possible jealousy and suspicion upon the entrance of Europeans, who might shake their authority there. A debt of gratitude was due to the Pundit, who had been exposed to great perils. When in Lhása he was recognised by some one who knew him, and it was only a question of time as to when he would be betrayed; and, in all probability, if he had been, no more would ever have been heard of him. However, when he was convinced that he was recognised, he gave his journals and observations to two of his attendants, and despatched them off to India, while he went forward for two days, in order to blind the authorities, and give his attendants a good start. That was a piece of true heroism. It was not that Englishmen were not capable of encountering the physical difficulties and dangers of such a route, but the political and religious element was sure to bar the way. In awarding Nain Singh the Gold Medal, the Council wished to show to the world that in bestowing their highest honour, they were not influenced by considerations of race, or creed, or nationality, but gave it to the men who had done the greatest service to Geographical Science.

ADDITIONAL NOTICE.

(Printed by order of Council.)

Voyage of the 'Ellangowan' to China Straits, New Guinea. By Rev. S. MACFARLANE.

WE left Somerset on the 21st of March, having on board our newly-arrived medical missionary, Dr. Turner, and his wife; also the teachers' wives from Yule Island, who had come over to recruit their health, and had sufficiently accomplished the object to enable them to return to their husbands and work.

We anchored for the first night at the lee-end of a reef near Village Island, and, although rocked all night, got very little sleep. Next day it was too rough to call at York Island—our wooding-station—so we ran on to Darnley. Here we found the teachers suffering from fever and ague, as well as the natives themselves, but nothing serious.

We started from Darnley on the morning of the 24th, and sighted Anchor Quay about noon. Crossing the Gulf we had a light head-wind; still we hoped to reach Yule Island by the evening of the following day. The sun set, and darkness came on, however, before we reached the passage, and a heavy squall came off the land, rendering it impossible for us to see our way. Having run what we supposed to be our distance, we anchored in 15 fathoms of water, and in the morning were pleased to find ourselves near the mouth of the pass.

It was a lovely Sabbath-morning when we steamed into Hall Sound. The wind and rain had ceased. The sun rose behind Mount Owen Stanley, dispersing the thick banks of clouds and lighting up the hills. The scene was grand. The mountain-ridges rose tier on tier, like mighty fortifications, piled up to the heavens, and patches of fleecy, snowy-white clouds lay on the hill-sides, as if the artillery from these gigantic batteries had been recently at work. Mounts Yule and Owen Stanley sat in solemn grandeur in the midst of this majestic scene like Nature's generals, with their bare heads in the clear atmosphere, and a cloudy plaid drawn around their shoulders. The rising sun and morning clouds made it quite a panoramic view, upon which we gazed long after we came to anchor.

The teachers Waunaea and Anederu came off in their boat, accompanied by Dr. James, formerly attached to the Macleay Expedition, who is collecting specimens of natural history in the vicinity of Yule Island. They had all been suffering from fever, indeed they had an attack the day before we arrived, but find Yule Island, on the whole, as healthy as most of the islands in Torres Straits. We went with them on shore, and found that the teachers had nearly completed their new house, which is neatly built on a cliff, situated on the weather side of the island about 2 miles from the anchorage. It is a two-story house, the frame of which is well put together, and covered in with pandanus-leaves neatly sewn together. The doors and shutters are made from the sides of old canoes.

The teachers appear to be making a favourable impression upon the people especially upon the young folks, who like to go with the teachers in their boat visiting, and who make a very good crew. The women seemed pleased to see the teachers' wives back again, and asked if Mrs. Turner was a woman! When they were assured that she was, the news passed from one to another, and all pressed forward to have a look. Mrs. Turner made the chief's wife a small present, who returned some time afterwards with two dishes of cooked food, which he presented to her. At the teachers' house we got the principal men together, to whom I addressed a few words through the teacher, explaining to them our object in coming amongst them. Having made them a small present, we left, returning by land across the island, which appears to be pretty well watered. After visiting several parts, we selected what seems to be the best site for a mission-station, notwithstanding the mangrove-swamp close by. It is a tolerably healthy plateau, about 200 feet above the level of the sea, exposed to both south-east and north-west winds, near a running stream of good water, and also near the bay, where there is a fine sandy beach, and one of the best anchorages on the coast of New Guinea.

A sad accident occurred whilst we were at Yule Island; Captain Redlich, of Torres Straits, had gone over in his cutter to see about some natives who had formerly been in his employ. He was anchored near the *Ellangowan*. Seeing a shoal of fish close by, and being accustomed to catch them with dynamite, he pulled off in his dingy with a native, lighted the charge of dynamite, and was in the act of throwing it, when it exploded, carrying away his left hand. The native pulled quickly to the *Ellangowan*, where he was taken on board by Captain Runcie. We had just arrived on the beach from our trip inland, when we heard the report of the dynamite and the shriek from Captain Redlich. We hastened on board, where we were met by the horrible sight of the shattered stump. We immediately sent for Dr. James, but as it would be about an hour before he could arrive, Dr. Turner commenced the operation at once, cutting away the shreds and bone at the wrist-joint, and had finished some time before Dr. James arrived. We took Captain Redlich with us to Port Moresby at his request, his crew following in the cutter, and there Dr. Turner attended him, whilst Mr. Lawes and I went to China Straits.

We found that Port Moresby had put on its best appearance. The recent rains had made the hills look fresh and green, many of which are now under cultivation. Several large canoes with cargoes of sago had just arrived from the Gulf, which enlivened the scene, the crews being busy, driving a brisk and noisy trade with the people of Port Moresby. It looked as if such a place must be healthy; but when we see every member of the mission, down to Mrs. Lawes' baby, suffering from fever, and count the number of teachers' graves, we are driven to a different conclusion.

I visited and examined one of the large canoes. Although rudely constructed, they are evidently the result of immense labour. It consisted of five logs about 40 feet long, hollowed out and lashed together. The outside ones were about 4 feet in diameter, the three inner ones being only half the size. It must take a long time and great labour to fell and cut out these large trees, with nothing but stone implements and fire. Having prepared the logs and burnt holes along the upper edges, they are placed alongside each other, about 6 inches apart; strong poles are cut and laid across the canoes to which they are lashed; so that when the vessel is "high and dry" it rests upon the two outer canoes, the three inner ones being suspended from the poles, to which all are tied with ratan. Thus their trading-vessels have really two keels; one on each side, instead of one keel in the middle like ours. The cross-poles are allowed to project about 4 feet over the canoe on each side, and are covered with small sticks, forming a balcony. Whilst level with the side of the outer canoes, a fence is erected, about 3 feet high, which is enclosed with the leaves of the sago-palm. The platform projects about 6 feet over the ends of the canoe. Each end of the enclosure is roofed in like a native house, and in these compartments men, women, and children, live during their voyages, much as they do when on shore. Some have only one, and others two masts, which are simply forked trees taken up by the roots, by which they are lashed to one side of the platform at an equal distance from each end of the canoe, and secured by two ratan straps fastened to the opposite side of the canoe at each end. The large mat-sail is a remarkable-looking object. It is like a boy's kite of immense size, except that the top is concave instead of convex, the two sides curving in a little, making the top of the sail the same shape as the moon appears when a few days old. The sail is hoisted by a rope fastened to the *side* of the sail at the widest part, and thrown over the fork of the mast. The other side of the sail has two ropes fastened to it, so that it can be hauled either way. In tacking, they simply move the rudder from one end of the canoe to the other.

Mr. Lawes joined us at Port Moresby, where Dr. and Mrs. Turner remained until our return. Having on a previous voyage visited the villages from Port Moresby to the western side of Hood Bay, we decided to commence with *Kerepunu*, which is situated on the eastern side of the bay, at the entrance to Hood Lagoon. We left Port Moresby on the afternoon of the 3rd of April, and steamed through the Basilisk Passage, hoping to run down under sail during the night, and so save our fuel; but the wind fell off, obliging us to keep up easy steam. On the following morning we stood in for Hood Bay, running along the reef on the eastern side. This reef, it appears, is fine fishing-ground. We saw about a hundred natives at work there. Being anxious to get as near the village as possible, we steamed slowly along the reef, hoping to find some passage through which we might push our little steamer; but there did not appear to be any opening. We returned to try and find anchorage under the lee of the barrier-reef; but could not find a bottom at 25 fathoms. Evening had set in, and we felt that we must anchor in the bay somewhere for the night; so we returned towards the head of the bay, and, when well up, saw, to our delight, a fine passage behind the reefs, large enough for a vessel of a thousand tons. We steamed up to the lagoon, and anchored in the entrance close to the village, which is a quiet and safe anchorage at all seasons.

It very soon became evident that we had dropped into a thickly-populated place. Canoes came off thick and fast; but there was no cause for alarm, as the people are friendly with those at Port Moresby, and some of the chiefs had met Mr. Lawes there. Our decks were soon crowded with men, women, and children, all talking at once, as loud and as fast as they could. They are a fine, healthy, strong, and active people; seemed mightily pleased with all they saw, and especially with what they got on board. They urged us to go and see their villages on the morrow, and went on shore to have a big dance, and dream of beads and hoop-iron. We heard the drums and singing nearly the whole of the night.

At an early hour in the morning the nine chiefs came off with a crowd of people. In order to secure a little space for breakfast, which we generally have on the skylight, we fastened a rope across the deck. It was highly amusing to see the dusky crowd pushing and fighting for good places to see the lions feeding! They seemed astonished at the "set out" on the table, and I daresay some of our friends at home would have been astonished too, though from a different point of view! They were evidently in doubt about the salt beef, and asked if it was human flesh. We gave them a piece of bread, which they examined and smelt, and passed from one to the other, also a little sugar; but no one had the courage to taste, although what the taste would have been in their dirty mouths, filthy with constantly chewing the betel-nut, chinam, and a kind of astringent bark, it is hard to say. At prayers they seemed bewildered, although they had evidently an idea that they ought to be quiet. We had some talk with the chiefs, some of whom could speak the Port Moresby language. Having made them a small present each, we accompanied them on shore, and were delighted to find on every side evidences of intelligence, industry, and cleanliness. We were conducted by the chiefs, and followed by a crowd of people through the township; which consists of nine villages, connected by lanes and gardens neatly fenced in; the former, like the villages, cleanly swept, and the latter well weeded. Although the houses and streets are overshadowed by trees, not a dead leaf or cocoanut-husk is to be seen. They must be swept at least once a day. Parrots and cockatoos are great pets, and are to be seen on the verandahs of many of the houses. One part of the people devote themselves to fishing, and the other to planting, neither interfering with the special work of the other, but each returning in the evening from fishing and planting to barter their provisions. The agriculturists never try to catch fish, nor the fishermen to plant, although they live together. A large plot of land is turned over very systematically and quickly by a number of men standing in a row, with a pointed stick in each hand, which they raise and plunge into the ground simultaneously, and then use them as so many levers to turn over the soil. It is surprising how quickly they can turn over an acre of soil in this way. They make and use a great number of canoes; some have outriggers, though they are mostly double, two lashed together about 18 inches apart. We saw them at work making a number of canoes, and were surprised at the adaptability and durability of the stone-axes, and their dexterity in using them. They cut very much better than some of the common axes sold to the natives by Europeans. The houses of the Kerepunuites are well built, their canoes neatly made, their gardens carefully cultivated, their streets kept clean; everything, indeed, appears to be done decently and in order. They understand well how to drive a bargain, and may be considered a commercial people in a much higher state of civilisation than many of their neighbours. The chiefs seemed delighted to walk with us arm-in-arm through the town, carrying our umbrellas. I noticed that walking arm-in-arm was quite common amongst them, especially among the young people. On the deck of the vessel, as well as in the streets and villages, the young women seem to hang on to the arms of the young men quite naturally. We suppose the town to consist of not less than two thousand inhabitants.

From the natives we learnt that a river runs into the lagoon which takes its rise behind the Astrolabe range, so we took our small boat and crossed the lagoon, which is about 15 miles in circumference, and from 5 to 9 fathoms deep at the entrance, and for more than half-way across; although it has hitherto been supposed that there was no passage into it, now, however, we have found it to be a splendid anchorage, large enough to accommodate a fleet. The river bears about N.N.E. from the entrance of the lagoon. We pulled up it for 1½ mile, found it 8 feet deep, and about 80 yards wide, although shallow at the entrance, there not being (the way we went) more than 2 feet of water at low tide. At first it bore to the east, and then took a pretty sharp turn round a range of hills and bore to the north-west, running, the natives say, between the Macgillivray and Astrolabe ranges. From the account of the natives, it would appear that the Astrolabe range is the watershed or source of this river and the Manumanu, the one running to the east and the other to the west. We have named our discovery the *Dundee*. It runs into a basin, about a mile in circumference, just before entering the lagoon.

On our return to the vessel, we found that some one had stolen a piece of rope during our absence, and that the chiefs were very angry about it, fearing we should (as they expressed it) consider them thieves, like the Port Moresby people. They immediately went on shore, and returned with the father of the boy who had stolen the rope, and who was willing to bear the punishment, and the chiefs seemed to think that he ought to receive it, if not for the rope, at least for their trouble in bringing him to the ship.

When we left Kerepunu, on the morning of the 6th of April, we were surrounded by canoes. The moment the natives found the steamer moving there was a general rush to the ship's side and a scrambling for canoes; some jumped into the sea at once; others made a leap for canoes, which they just missed; whilst others crowded into a small canoe, which quietly took a tack downwards, and so got rid of the lot. The scolding and shouting and laughing was amusing and deafening. They seemed astonished and bewildered at the vessel moving away without sails or oars. Soon after we started the breeze freshened, so we set our square sail and stopped the engine. In the afternoon we came to anchor under the lee of Constance Island, a small island just inside the barrier reef, with a beautiful sandy beach all round, thickly wooded, and the home of hundreds of pigeons. This is a good and convenient anchorage for vessels running along the coast if in want of a safe place for the night, where they may easily get a good supply of pigeons for all hands. It will be a good wooding station for our little steamer. It is about a mile in circumference and 7 miles from the mainland. We saw a large canoe at anchor on the reef about 2 miles off, and soon after we landed five small ones approached us from the reef. We went towards the place where they seemed disposed to land, but they evidently did not desire any intercourse with us, and pulled away, waving us off. Returning to the place where we landed, we went round the island the other way, to meet the fishing-party from the canoes, who evidently intended camping there for the night. We came upon them with their canoes hauled up, so that they could not get away before our arrival. They still waved us back, but we continued quietly walking forward, making friendly signs. They were busy preparing the fish they had caught for preserving to be taken to their homes on the mainland. Their language bears some resemblance to that spoken at Port Moresby, although the similarity appears to be very slight. They were delighted to get the feathers of the pigeons which our natives had shot, explaining to us, in a most graphic and unmistakable way, that they wanted them to make head-ornaments for the dance. After we had been with them a little while, they seemed to come to the conclusion that we did not intend to *eat* them, and were not such bad fellows as they at first thought. It was what sailors call "dirty weather," so that when we returned to the ship with our wood and pigeons, we were ready for a bath and a dry suit. Before we left next morning some of the boys went off, and brought back thirty-three pigeons before breakfast, and the natural consequence of so much pigeon-eating was that on the following day the doctor had more to do than the steward.

We visited the coast of the mainland opposite Constance Island, hoping to get our little steamer into what appeared to be a bay or inlet, or perhaps a river. We found the approach shallow, were obliged to anchor about a mile and a half from the entrance in 9 feet of water, although there is probably a deep channel. Several canoes came off, but the natives were unarmed, and had evidently but one idea, viz. barter. Their canoes were the first I had seen in New Guinea with sides, although the natives themselves are not near so fine a looking race as the Kerepunuites. Their ear-ornaments are peculiar. Instead of piercing their ears, a bunch of beads is fastened to each end of a string which is passed behind the head, so that the beads hang over the front part of the ears. They have but few ornaments, and appear to be but a poor people. We steamed out into deeper water for anchorage for the night, and next morning Mr. Lawes and I started in the small boat, with three natives, to see what the place was like. By keeping to the eastern side of the opening, we found the water from 3 to 5 fathoms deep. There is a bar at the entrance, which runs nearly across, but by keeping near the bluff on the east side of the opening, a narrow passage will be found, from 4 to 5 fathoms deep. The bluff is above 100 feet high and wooded. On the opposite side is both land and a sandy beach. After pulling half a mile from the bluff, we opened into a lagoon, about 5 miles in circumference, in which is the village of *Aloma*, consisting of about fifty houses built over the water on piles. This lagoon is shallow in the middle and nearly 3 fathoms deep at the sides. Proceeding across the lagoon, in a north-easterly direction, we found a passage about half a mile wide, along which we pulled for about a mile, when we opened into a beautiful lagoon, 4 miles long and 2 wide, with a village on a sandbank, nearly a mile from the eastern side, consisting of about thirty houses. On each side, and before us, the hills were near, though the banks of the lagoon are not well defined, as the trees grow for some distance out into the water. Pulling across this lagoon, which is only half as salt as sea-water, we found what we now concluded to be a river, 20 yards wide and 3 fathoms deep, bearing to the east. About a mile and a half further up it branches off in two different directions, one towards the south-east, the other to the north-west. We followed the south-east arm about a mile, and then returned, leaving it, no doubt, meandering amongst the hills. The highest point we reached was about 9 miles from the bluff, and we left the river, still about 20 yards wide and 3 fathoms deep. For the exploration of such rivers as these a steam-launch is necessary. It is dangerous as well as hard work to pull a boat a long distance in such a climate. On our way back we called at the village in the large lagoon; the people were very frightened, families were in their canoes on the opposite side of the village ready for flight. There were some miserable-looking pigs running about under the houses, which seemed as much afraid as their owners, but had they known our feelings respecting them, they would have felt that there was no cause for alarm. After some time, we managed to get some of the men off in their canoes with vegetables to sell for beads, and left them on the most friendly terms. The lagoon is a most picturesque spot. We have named it *Marshall Lagoon*, and the river we have called *Devitt River*, which is another known easy route to the mountains. To distinguish the bay, which has no name on the chart, we propose calling it *Shallow Bay;* it bears about north from Constance Island.

From Shallow Bay we continued our voyage inside the barrier-reef to Cloudy Bay, where we anchored between a long reef and Eugenie Islet; this islet is not in the middle of the bay, as was supposed, but near the west side. Cloudy Bay is rightly named; it has a very gloomy appearance. The clouds never seem to leave the hills in that locality, and the hills are all densely wooded, giving them a very dreary aspect. Judging from the little smoke to be seen, we suppose that the place is very thinly populated. Three miles from the north-east of Eugenie Islet is a small island, about 100 feet high and 2 miles in circumference, well wooded; on the east side of which (and probably on the west, too) there is a good deep channel into the inner bay. To the east of this island is another, which is low, well-wooded, and about 2¼ miles long; it is separated from the other by a passage 150 yards wide, which looks deep, but we did not go through it. Between these two islands and the mainland, a distance of 3 miles, is a fine bay, 3 fathoms deep wherever we sounded; at the head of which there appeared to be a creek or river, which we did not examine. Pulling in an easterly direction past the two islands, we landed at a point opposite the opening at the east side of the low island, where there are a few coconut-trees and oysters. From this point to the land opposite the distance is about 200 yards. Proceeding castward, we entered a beautiful harbour, bearing about north-east, three-quarters of a mile wide and 5 or 6 miles long, and 3 fathoms deep, surrounded by thickly-wooded hills, which slope down to the water's-edge. There did not appear to be any villages on the shores of the harbour, although landing-places and native tracks appeared in several places. This harbour may be the scene of busy European life at no distant date. We have named it Robinson Harbour, and the two islands the Sewell and Percy Islands; the high one being Sewell, and the low one Percy Island. We returned by the passage to the east of Percy Island, which is from 3 to 5 fathoms deep. The best entrance both to the island and the bay behind the two islands is by this passage, entering from the east side of Cloudy Bay. We went in at the west side and left by the east; the former is rendered intricate by numerous reefs. On our return to the ship we found a large canoe close by, full of women; there not being a man on board, we felt sure that we were near the much-spoken of *Haine Anua*, Woman's Land, and the Raratongan teachers had been off and learnt this fact from the women themselves. They told them that we would be back soon, and asked them to wait. Having returned weary and hungry, and finding that the steward had a pretty good spread-out on the skylight, we fell to at once, waving to our fair sailors to come and join us, intending, however, to pay them a visit after dinner; but they, true to their sex, could not brook such treatment, and, to our chagrin, hoisted their sail and left us.

Thence we steamed to a village at the east head of Cloudy Bay, which should be Colombier Point, although it is really between the two places marked on the chart as Colombier Point and Table Point. It is very desirable that a thorough survey should be made of Cloudy Bay, and, indeed, the whole of the south coast of the peninsula. We had hoped that this village would turn out to be the Woman's Land, but before we got to anchor the men were swimming off with articles for trade. It does not appear that any white men had been there before. We visited their village on the following day, whilst the crew were cutting wood. It was with great reluctance and fear that they allowed us to approach the village. For a long time they took us by the hand and desired us to embark again, giving us to understand that the women and children were afraid, although, from the look of all parties, it appeared that they themselves were most concerned in the matter. We tried to assure them of our peaceful intentions, and moved along the beach towards the village. After many stoppages and entreaties, which we found were only meant to gain time, we reached the village, which consists of 15 or 20 houses, surrounded by a strong stockade about 14 feet high. The entrances were all barricaded, on our account, no doubt. From the inside the women were peering at us like pent-up cattle, whilst the men stood guard outside. They seemed to be satisfied before we left of our peaceful intentions, and asked us to come again. They were greatly astonished, like all the others, indeed, along the coast, at our white skins and umbrellas, and were very anxious to get hoop-iron. The village is called *Dedele*. Leaving there, we steamed to a small island on the barrier-reef, called Grange Island, to fill up with wood. The island is much the same as Constance, but the anchorage is not so good. Some of the natives went on shore in the evening, and returned with 53 pigeons and some flying foxes. We remained there a whole day, cutting wood for fuel.

On the morning of the 13th we started for Amazon Bay, at the mouth of which are five small islands, connected, or nearly so, by reefs, between which and the mainland there is good safe anchorage at all seasons. The entrance both from east and west is near the mainland; and about a mile wide. Two of the Amazon isles are covered with coconut-trees, on one of which we found good water, although not much of it. We found good anchorage behind these two islands. Toulon Island is the largest of the group, and contains groves of coconut-trees, and a large village. Several canoes came off full of natives, all anxious to get hoop-iron. They were unarmed, and were accompanied by women and children. Some large canoes were hauled up on the beach of the mainland, where the natives from the islands appear to make plantations. The hills about Amazon Bay are thickly wooded, and some of them slope down to the water's edge.

On the following morning we steamed out of Amazon Bay on the east side, passing what we feel pretty sure will prove to be a large island, as we saw nearly through the passage. We noticed several villages on the hills, and smoke in many places. One of these villages was near the top of a mountain, nearly 1000 feet high. From Amazon Bay to China Straits we found the coast thickly populated. We steamed along inside Dufaure Island, between which and the mainland there is good anchorage. A number of canoes came off from the island; but we did not stop to hold any intercourse with the natives, being anxious to get to the opening ahead before dark, which looked like the entrance to a lagoon, or deep inlet. We kept on our way to the eastward, past Dufaure Island, between the east side of which and the mainland the passage is only about three quarters of a mile wide. Proceeding through a clear opening about a mile wide, we entered a magnificent harbour, about 8 miles long and 4 wide, from 8 to 10 fathoms deep, with a muddy bottom. On the shores of this harbour are numerous sandy beaches of considerable length, with groves of coconut-trees and villages, from which small fleets of canoes issued, and fastened on to us as we passed along. Our decks were soon crowded, which of course we should not have allowed had there been any signs of hostility. To those acquainted with natives such designs cannot well be concealed. The natives had some spears and clubs with them, but they were evidently for defence or for sale. There were no signs, as up the Fly River, of a pre-arranged, well planned, and determined attack. We anchored near the shore, about half-way up the harbour, at what we considered would be a convenient place for cutting fuel. We were glad when the darkness led our new acquaintances to clear out for the night. They appeared to be a peaceful, intelligent people. They are certainly a noisy, merry set of fellows, all wild after hoop-iron.

All along the coast, between Amazon Bay and China Straits, the natives are not only more numerous, but more intelligent, and look more healthy. They dress very respectably compared with the natives to the westward; the women are much the same, wearing girdles of grass, or leaves down to their knees, but the men have a very decent kind of fore-and-aft rig, made with pandanus leaves. During the night the natives were assembling on the beach opposite our anchorage ready for trading in the morning. They kept up a constant chatter throughout the whole night, and at daybreak eighteen canoes came off with vegetables for sale. Amongst them were a lot of young fellows who appeared to have made up their minds not to go back empty-handed, and did not seem at all particular how they came by the things. Some of them had got the furnace-door in their canoe, others the windlass handle, and others a blanket. These we recovered; but fearing lest we should come into collision with the people if we remained to cut wood, we weighed anchor and steamed away from them. Like the natives at the other places, they were astonished when we quietly moved from the midst of their canoes. On our way out of the harbour we met numerous canoes, but did not stop. Orangeric Bay is very thickly populated, more so than any part of the coast we have yet visited. We went out at the passage between Dufaure Island and the mainland, or what may prove to be a large island, as we did not go to the head of the harbour, where there appeared to be an opening. Orangerie Bay is likely to become the most important part of the south-east peninsula, both from a missionary and commercial point of view. Our important discovery we have named *Mullens Harbour*.

To the east of Eagle Point there are numerous bays and sandy beaches, every one of which is studded with villages. The hills are all under cultivation, and on every side there are indications of active life. It was blowing freshly from the S.E., against which it was difficult for our little steamer to make headway, especially with wood fuel, so we ran into what appeared to be a bay, likely to afford shelter, about a mile to the west of the most western of the Roux Islands, and found what will probably become one of the most frequented anchorages along the coast. Nothing could be more convenient and snug. The bay is clear. When opposite, you run right in for the middle, steering north, and at the head of the bay bear to the east, and you find yourself in a beautiful cove, safe from all winds, surrounded by lovely hills, at the base of which are sandy beaches, groves of coconut-trees, and two or three villages. The people are quiet and friendly, and not too numerous to manage, as at Orangerie Bay. They came off to us with vegetables, and curious for iron-hoop; and we went on shore, where we got plenty of wood, and good water from a running stream. So that vessels passing may run in here for wood, water and vegetables, and in a few minutes pass from a high sea to a quiet anchorage.

We were rather surprised and pleased to find how much attention and respect they showed towards their dead. Close to the village we observed a grave, neatly enclosed by a low stone wall. At the head, two papau apples were growing, and some crotons at the feet, the enclosure being well weeded. It was here that we first met with a remarkable style of canoe, which we afterwards found more common as we neared the Straits. These war or state canoes looked very handsome and graceful when moving along at a distance under paddles. They are elaborately carved, and decorated with white shells and streamers; high at each end, and worked off in scrolls, looking like two great swans white as snow. Inside, the carved work is sometimes painted red or black, but nearly the whole of the canoe is kept beautifully white. Carved birds, &c., are fastened on sticks, and stuck into different parts of the canoe. Even the outrigger is painted in stripes of white and black which, at a distance, when the canoe is being pulled by twenty men who are all hidden but their heads and shoulders, gives it the appearance of an old Roman galley.

From this point eastward the natives seem very fond of carving. Their chinam pots and spoons, sago batons, clubs and spears, canoes and paddles, and all their ornaments, are skilfully carved, and almost every one of them, except the canoes, may be bought for a piece of hoop-iron. During the night the news of our arrival spread, and in the morning we were surrounded by thirty-four friendly canoes. Their could be no mistaking their peaceful intentions. Some of the natives helped our men to cut and carry wood, and one of them slept on board the *Ellangowan*. Although the cove itself is a nice quiet place, there are plenty of natives in the vicinity. To the east as well as to the west there are numerous sandy beaches and coconut-groves, swarming with natives. The entrance to the cove is easily known by a remarkable-looking rock, on which stands a prominent tree on the east side of the bay, about half a mile from the land. We have named it *Runcie Rock*, and the anchorage *Isabel Cove.*

Proceeding to the eastward, we soon sighted what we supposed to be "Tree Island," but which turned out to be "Wedge Rock" There is no island off the western head of Farm Bay as marked upon the latest charts, and this is very misleading to vessels running along the coast, as there is one within 8 miles corresponding to the description of what has hitherto been supposed to be the South Cape of New Guinea, but which we have proved to be an island by passing, in the steamer, between it and the mainland. Entering the bay between Rugged Head and Wedge Rock, we steamed about 3 or 4 miles, and then opened up a fine passage, half a mile wide, and 5 fathoms deep, by which we entered Catamaran Bay. What was supposed to be the South Cape of New Guinea, we have named *Stacey Island.* As we opened up the passage, we saw what appeared to be unbroken land on both sides for 12 or 14 miles, and wondered where we were going. As we proceeded, however, the passages between Stacey, Tissot, and the Brumer Islands opened up to the south. There is good anchorage between Stacey Island and the mainland. The island is hilly, the highest peak being about 600 feet above the level of the sea. It is triangular in shape, about 4 miles long, and populous. At the head of the bay opposite the passage between Stacey Island and the mainland, there is a bay running to the westward, which probably meets the one running eastward at the top of Farm Bay, making Rugged Head an island also; so that the southernmost extremity of New Guinea cannot yet be fixed with certainty. As we were on a Missionary voyage, looking for suitable places to establish mission stations, we did not feel justified in spending more time for the solution of these points. Our discoveries will show that there is plenty of important work for one of Her Majesty's ships all along the southern side of the peninsula; and although we do not profess to be accurate in our positions, we hope that the information gained, and willingly given to the public, will be of service until a proper survey is made by appointment of the Government. In the mean time, it is to be devoutly hoped that all vessels visiting the coast will, in the interests of commerce, as well as of humanity and religion, strictly observe a peaceful policy with the unsuspecting natives.

We came to anchor for the night at the west end of the Leocadie Islands, between a long reef and the mainland, and were very soon surrounded by a number of canoes and catamarans; but the natives, as at the other places, appeared friendly. We did not find during our voyage any of those signs of hostility and treachery which are mentioned in the Directory. When we started on the following morning at half-past six o'clock there were forty-five canoes around the *Ellangowan.* The natives were all clamouring for hoopnon, but our supply was far short of the demand, which led us to cut up one of the old plates of the ship, which, being thicker, was greatly prized. Any person visiting those parts should take a large supply of pieces of good thick hoop-iron, about an inch and a half wide and 6 inches long, and sharpened at one end, with these he may obtain vegetables and valuable curiosities.

We steamed into China Straits to the west of Heath Island; 3 miles from which, in a westerly direction, there is an island close to the mainland, 300 feet high, and three-quarters of a mile long. Off the north end of Heath Island are two small islands, nearly joined to it at low tide, which are woody, contain several groves of coconut-trees, and are inhabited. Many canoes came off from Heath and Hayter Islands, which appear to be thickly populated. They seem to use all kinds of canoes in and about China Straits, from the catamaran up to the beautiful white war canoes; and several kinds of sails from the large one I have described, down to a common plaited coconut-leaf. Entering Possession Bay, we saw a brig at anchor at the north side of Mekinley Island, which we passed, and found to be the *Rita* of Sydney. The crew were on shore cutting wood, where a tent was erected. The captain said they were fishing for *bêche-de-mer*, had been out ten months, and at Mekinley Island ten days, and about to leave. Having got a view of Jenkins and Milne Bays, we returned to Possession Bay, where we anchored for the night. This is a rather gloomy place, from the absence of any native village, and the mangroves all round the bay.

On the following day twelve of the large white canoes called at the *Ellangowan* on their way to Milne Bay, also a number of small ones. All were anxious to get hoop-iron. In addition to clubs and spears they had a great many stones laid along the sides of the canoes, to be used as shot, no doubt, in case any disturbance took place, but, like the others, they did not seem disposed to quarrel. The natives from Heath Island appear the most tractable, and were wild with delight when they found that we were going to anchor for the night near them. We were sorry that we had not more hoop-iron for the poor fellows; it was the one article in demand, and there was little use extending our voyage without it. If we had had a supply, we might have gone as far as Moresby Island; but the object of our voyage was accomplished, which was chiefly to find, if possible, during the calm season, anchorages along the coast into which we might run in heavy weather, and without steam, if thought desirable, after we have established our mission along the coast, and to look out for suitable places for the location of native pioneer missionaries. We are happy in the successful completion of a very interesting voyage. We think that all along the coast friendly relations might be easily established and maintained with the people; and it is our intention to commence, as early as practicable, a Mission in China Straits to work eastward and meet the one already established at Port Moresby. The eastern end of the peninsula, with the islands in the vicinity, including the D'Entrecasteaux group, will form a much finer field for Missionary operations than the Gulf, with its dangerous navigation, deadly fever, and savage cannibal inhabitants.

Our voyage has also been one of important discovery. We have found two rivers, two splendid harbours, a safe, snug and convenient cove, several islands, and plenty of good anchorages all along the coast. We have found the natives numerous and friendly, looking healthy, and apparently in the midst of plenty of food. They brought off to us some flax, in small quantities, of a superior quality, which might become an article of commerce. With that exception, we did not see anything of commercial value. The country may be rich, and probably is, in mineral wealth, but it has yet to be found. At present it is a fine field for missionaries, naturalists, and explorers, who will best prepare the way for settlers.

Our return voyage to Port Moresby was accomplished in a few days. We ran back under sail most of the way outside the barrier reef, calling at Isabel Cove, and Hood Lagoon (Kerepunu) arriving at Port Moresby about 8 P.M. on Saturday, April 22nd, where we found all well. On Saturday the 29th we left for Cape York; calling at Yule Island for wood fuel. Here we found Dr. James considerably reduced by fever, and anxious to go to Cape York to recruit his health. He intends returning in the *Ellangowan* next month, to continue his collecting in the vicinity of Yule Island. From Yule Island we had a pleasant passage to Cape York, where we arrived on the 6th of May, having called at Darnley and York Islands.

Those who take special interest in the movements of our little steamer *Ellangowan*, will be pleased to learn that she has served us admirably well, exceeding our highest expectations. For two years we have had her constantly employed, burning chiefly wood; she has enabled us to open up our Mission field, which we could not have done without steam.

PRIZE MEDALS

OF THE

ROYAL GEOGRAPHICAL SOCIETY.

REPORT FOR 1877,

AND

PROGRAMME FOR 1878.

SYNOPSIS OF RESULTS

OF

PAST EXAMINATIONS.

	Physical Geography.	Political Geography.
1869.—	*Examiner*, A. R. Wallace. (*Special Subject: Palestine.*)	*Examiner*, Rev. W. G. Clark.
Gold Medal	W. Grundy. (*Rossall.*)	H. C. Richmond. (*Liverpool College.*)
Bronze Medal	G. W. Gent. (*Rossall.*)	J. D Wilde. (*Manchester Grammar School.*)
Honourably Mentioned	G. G. Butler, M. Stewart, A. Wilson, G. B. Brown, E. Thomas.	E. Crabb, J. H. Collins, M. L. Lewis, H. B. Dixon, D. S. Bontflower.
1870.—	*Examiner*, A. R. Wallace. (*Special Subject: India.*)	*Examiner*, Very Rev. Dean Howson, D.D.
Gold Medal	G. G. Butler. (*Liverpool College.*)	G. W. Gent. (*Rossall.*)
Bronze Medal	M. Stewart. (*Rossall.*)	J. H. Collins. (*Liverpool College.*)
Honourably Mentioned	W. Hind, G. Hughes, F. J. Beckly, F. W. Hunt, R. F. W. Shaw, E. C. Thomas.	E. Crabb, William Grundy, George Hogben, J. D. Murray, H. B. Dixon.
1871.—	*Examiner*, Dr. W. B. Carpenter, F.R.S. (*Special Subject: British North America.*)	*Examiner*, C. H. Pearson, M.A.
Gold Medal	D. McAlister. (*Liverpool Institute.*)	G. Hogben. (*University School, Nottingham.*)
Bronze Medal	W. G. Collingwood. (*Liverpool College.*)	R. N. Arkle. (*Liverpool College.*)
Honourably Mentioned	R. A. Lundie, W. N. Shaw, W. C. Hudson, F. J. Beckley, T. Disney, W. E. Evill, H. R. F. Brown, W. B. Ffooks.	F. M. Sparks, J. B. Heath, D. S. Bontflower, A. Hassall.
1872.—	*Examiner*, H. W. Bates, F.L.S. (*Special Subject: South America.*)	*Examiner*, T. W. Hinchliff, M.A.
Gold Medal	S. E. Spring-Rice. (*Eton College.*)	W. G. Collingwood. (*Liverpool College.*)
Bronze Medal	A. S. Butler. (*Liverpool College.*)	W. C. Graham. (*Eton College.*)
Honourably Mentioned	C. Penrose, E. Dickson, J. R. White, H. de V. Vane.	R. H. Sayle, W. L. Kingsford, H. E. Dixon.

		Political Geography.
1873.—*Examiner*, Dr. J. D. HOOKER, F.R.S. (*Special Subject: Eastern and Western Turkestan.*)		*Examiner*, Maj.-Gen. Sir H. C. RAWLINSON, K.C.B.
Gold Medal	W. C. HUDSON. (*Liverpool College.*)	S. E. SPRING-RICE. (*Eton College.*)
Bronze Medal .. .	W. A. FORBES. (*Winchester College.*)	A. T. NUTT. (*University College School.*)
Honourably Mentioned	A. C. Cole, R. C. Reade, H. H. Hancock, H. Louis, N. M. Richardson, G. S. Pawle, G. R. Townsend, W. S. Widdicombe.	A. Williams, W. L. Kingsford, G. H. Sing, S. H. B. Saunders, A. Hassall.
1874.—*Examiner*, Prof. A. C. RAMSAY, LL.D. (*Special Subject: The British Isles.*)		*Examiner*, Rev. Canon RAWLINSON, M.A.
Gold Medal	L. WESTON. (*City of London School.*)	W. H. TURTON. (*Clifton College.*)
Bronze Medal	F. C. MONTAGUE. (*University College School.*)	L. JACOB. (*City of London School.*)
Honourably Mentioned	H. M. Platnauer, W. S. Widdicombe, C. A. Spring-Rice, H. A. Miers, C. Healey, W. F. Wilson, A. R. Forsyth.	J. F. Heyes, S. H. B. Saunders, R. W. Whiston, W. B. Styer.
1875.—*Examiner*, General R. STRACHEY, R.E. (*Special Subject: China.*)		*Examiner*, Sir RUTHERFORD ALCOCK, K.C.B.
Gold Medal	H. A. MIERS. (*Eton College.*)	S. H. B. SAUNDERS. (*Dulwich College.*)
Bronze Medal .. .	A. E. GARROD. (*Marlborough College.*)	W. C. GRAHAM. (*Eton College.*)
Honourably Mentioned	C. A. Spring-Rice, H. Perrin, H. H. Hancock, W. D. Thomson, H. M. Platnauer.	J. Vans Agnew, W. M. H. Milner, J. F. Heyes, D. G. Crawford, T. Knox, A. S. Moriarty.
1876.—*Examiner*, Prof. T. RUPERT JONES, F.R.S. (*Special Subject: The Arctic Regions.*)		*Examiner*, Sir F. LEOPOLD McCLINTOCK, F.R.S.
Gold Medal	JNO. WILKIE. (*Liverpool College.*)	THOMAS KNOX. (*Haileybury College.*)
Bronze Medal .. .	WALTER NEW. (*Dulwich College.*)	W. M. H MILNER. (*Marlborough College.*)
Honourably Mentioned	J. A. Robinson, L. P. Jacks, E. von Lengerke, Sir M. Crofton, F. S. Carey.	J. B. Johnston, H. W. Pigeon, J. F. Heyes, W. J. Newton, A. R. Ropes, C. W. MacMaster.
1877.—*Examiner*, FRANCIS GALTON, M.A., F.R.S. (*Special Subject: Africa, South of the Equator.*)		*Examiner*, Sir RAWSON W. RAWSON, K.C.M.G., C.B.
Gold Medal	WALTER NEW. (*Dulwich College.*)	William John Newton. (*Liverpool College.*)
Bronze Medal	ARTHUR SMYTH FLOWER, (*Winchester College.*)	John Wilkie. (*Liverpool College.*)
Honourably Mentioned	John Chisman, J. A. Robinson, Frank Stanton Carey.	Arthur Reed Ropes, William Wallis Ord, Samuel Fowler Blackwell, George Arnold Tomkinson, Henry Colthurst Godwin.

TABULAR SUMMARY OF AWARDS OF MEDALS ACCORDING TO SCHOOLS.

Total.		Gold.		Bronze.	
		Physical.	Political.	Physical.	Political.
2	City of London	1874	.. ..	.. ..	1874
1	Clifton	.. ..	1874	.. ..	.. ..
3	Dulwich	1877	1875	1876	.. ..
5	Eton	1872, 1875	1873	.. ..	1872, 1875
1	Haileybury	.. ..	1876	.. ..	.. ..
11	Liverpool College	1870, 1873, 1876	1869, 1872, 1877	1871, 1872	1870, 1871, 1877
1	Liverpool Institute	1871	.. ..	.. ..	.. ..
1	Manchester School	.. ..	.. ..	.. ..	1869
2	Marlborough	.. ..	.. ..	1875	1876
1	Nottingham	.. ..	1871	.. ..	.. ..
4	Rossall	1869	1870	1869, 1870	.. ..
2	University College School	.. ..	.. ..	1874	1873
2	Winchester	.. ..	.. ..	1873, 1877	.. ..

36 in nine years—13 Schools.

Liverpool College	11	Dulwich	3	Winchester	2	Haileybury	1
Eton	5	City of London	2	University College School	2	Liverpool Institute	1
Rossall	4	Marlborough	2	Clifton	1	Manchester School	1

Nottingham 1

PRIZE MEDALS

ROYAL GEOGRAPHICAL SOCIETY.

INSTITUTED, 1869.

RESULTS OF THE EXAMINATION FOR 1877.

List of Schools who were invited to compete in 1877.

English Schools.—St. Peter's College, Radley, Abingdon; King Edward's School, Birmingham; Brighton College; Bristol Grammar School; Cathedral Grammar School, Chester; Cheltenham College; Clifton College; Dulwich College; Eton College; Haileybury College; Harrow; Hurstpierpoint; Liverpool College; Liverpool Institute; London,—Charter House; Christ's Hospital; City of London School; King's College School; St. Paul's; University College School; Westminster School; Royal Naval School, New Cross;—The College, Malvern; Manchester School; Marlborough College; University School, Nottingham; Repton; Rossall; Rugby; King's School, Sherborne; Shoreham; Shrewsbury; Stonyhurst College, Blackburn; The School, Tonbridge; Uppingham School; Wellington College; Winchester College.

Channel Islands School.—Victoria College, Jersey.

Scotch Schools.—Aberdeen Grammar School; Edinburgh Academy; Edinburgh High School; Glasgow High School; Glasgow Academy.

Irish Schools.—Royal Academical Institute, Belfast; Dungannon Royal School; Ennis College; Portora Royal School, Enniskillen; Foyle College, Londonderry; Rathfarnham, St. Columba's College; Rathmines School, Dublin.

Seventeen of the above Schools furnished competitors, according to the following list, in which is entered the number of candidates in Political and Physical Geography from each school:—

	Physical.	Political.
Marlborough College	1	1
Rathmines School, Dublin	0	2
Victoria College, Jersey	2	0
Brighton College	1	1
University College School	2	1
Charterhouse School	0	1
Eton College	1	0
City of London School	2	2
Clifton College	0	4
Haileybury College	0	2
Liverpool College	4	2
Dulwich College	3	1
Edinburgh High School	0	1
Bristol Grammar School	2	0
Cheltenham College	2	1
Rossall School	1	1
Winchester College	1	0
Total	22	20

The Examiners appointed by the Council for 1877 were Francis Galton, Esq., F.R.S., for Physical, and Sir Rawson W. Rawson, K.C.M.G., for Political Geography. The examinations were held at the various schools, on the 19th of March, and the Prizes were presented at the Anniversary Meeting of the Society.

The special subject for the year 1877 was—

AFRICA, SOUTH OF THE EQUATOR.

PHYSICAL GEOGRAPHY.

No. 1 EXAMINATION PAPER, 1877.

General.

[*Candidates are required to answer not less than the specified number of Questions in each Group.*]

Group A (THREE *Questions must be answered*).

(1). Draw a circle of about four inches in diameter, to represent a section of the Globe through the mean Sea-level at N. Lat. 35°. Write the names of the more important places and districts through or near which it passes, inserting them (radially) in their proper longitudes, and within or without the circle, according as they lie to the N. or S. of it.

(2). On a circle, similar to that specified in the last Question, write the approximate elevations of such Plateaux and Mountains, and of such depressions of Sea-bottom in or about N. Lat. 35° as you may remember (in all cases omitting units and tens of feet). Guided by these entries, describe on the circle a section of the Land and Sea. Make it on the scale of about $\frac{1}{30}$ of an inch for each 1000 feet of vertical elevation or depression, and indicate the land with a red pencil, and the water with a blue one.

(3). Two lines are drawn on a globe from Cape Horn, the one passing continually to the N.W., and the other to the N.E. Through what places will they pass, whereabout will they intersect for the first time, and what, in general terms, will be their subsequent courses?

(4). A globe is put into a cubical box, which it fits. One side of the box touches the globe in N. Lat. 55° and Long. 0°; another side is known to touch it at a point somewhere on the Equator. What districts on land or sea are adjacent to each of the six points at which the globe is touched by the box? Give a list of the latitudes and longitudes of those six points.

(5). Give a concise and general summary of the distribution of Land and Sea over the Globe.

Group B (*this Question must be answered*).

(6). Suppose a geographer, unprovided with instruments, to be set in the month of March, for the space of twenty-four hours, by a desert watering-place in one or other of the following regions:—Sahara, Gobi, Australia, Utah, Kalahari. By what indications of sky and air, of plants, of animals, of tracks of travellers, and traces of their encampments, could he form an opinion in which of them he was?

Group C (ONE *Question must be answered*).

(7). Explain the various conditions by which Ocean-currents may be produced? How are the Currents in the British Channel affected by the Tides?

(8). What are Isothermal Lines? Define a "mean." In what way are mean temperatures determined approximately, and in what way accurately? What is the general direction in January and July respectively, of the Isothermal that passes through London? Why is its direction different in those months?

(9). What are Cyclones and Anticyclones? Of what nature and area are the Storms that usually pass over the British Isles? Whence do they come, at what rates do they travel, and where do they appear to disperse? What is the meaning of "Barometric Gradients"? State what you know about them.

Group D (THREE *Questions must be answered*).

(10). What are the supposed causes of Volcanic action? Describe the principal Volcanoes between Australia and Kamtchatka.

(11). Account for the size and shape of the grains of ordinary Desert Sand. What is the process by which ripple-marks are formed on its surface by wind? Explain the nature of Sand-dunes; how is it that they change their positions? Give instances of their doing so. What is Sandstone?

(12). What is the evidence of Rocks having been transplanted on a large scale, and to many regions, by drifting Ice? Describe the whole of the process.

(13). How are Deltas formed, and what is their stratification? Give examples to illustrate the rate of their formation at the mouths of large rivers.

Group E (THREE *Questions must be answered*).

(14). Describe the more striking features and characteristics of a Brazilian Forest by the Lower Amazon.

(15). How might it be shown, from the Biblical accounts of the fruits and cereals of Palestine, that the climate of Syria has not materially altered since the beginning of the Christian era?

(16). Give a list of the Animals domesticated by man, and state, so far as has been ascertained, the countries in which they were indigenous.

(17). What do we know of the races of the men and of their habits, who lived in Europe in prehistoric periods? What is the nature of the evidence on which the phrase "Indo-Germanic race" is founded?

Group F (*this Question must be answered*).

(18). Draw a map from the following notes, on the scale of about half an inch to a mile:—

I climbed to **P**, the highest point in the island. The ridge **PQ**, on which it stands, runs generally W. and E., but it curves somewhat to the northward before ending westward in **A**, a narrow promontory. The inland face of **PQ** is steep and escarped. **CD** is the crest of a long low hill parallel to **PQ**; its further side forms the cliff of the northern coast. A stream runs W. down the valley at the foot of **PQ**. From **P**, I took a round of bearings as follows:—to **A**, W.N.W.; to **B**, N.W.; to **C**, N.; to **D**, E.N.E.; to **F**, E.S.E.; to **G**, S.S.E.; to **H**, S. Then I made my way along the ridge to **Q**, 6 miles E. of **P**, whence I took a second round of bearings as follows: to **B**, W.N.W.; to **C**, N.W.; to **D**, N.E.; towards **E** (the termination of the ridge 1½ mile off), E.S.E.; to **F**, S.; to **G** and **H**, both in same line, W.S.W. **A** could not be seen from **Q**, but when seen from **P**, it was judged to be in a line with **B** and **C**. As regards the objects to which these letters refer, **B** is the mouth of the stream, in a shingly delta extending ¼ mile to seaward between two shallow bays. **C** is the west end of the ridge **CD**, and **D** is its east end. **E**, **F**, **G**, and **H**, are all of them capes formed by spurs from the main ridge. Between **D** and **E** there is a bay, deepest immediately to the north of **E**. The coast between those points is low, but the land rises at the back, and soon reaches the watershed. Between **G** and **H** is a deep narrow bay. Between **F** and **G** the coast is steep, but broken by ravines. From **H** to **A** the coast sweeps round the spurs of the main ridge in a bold curve. The Altitudes are as follows,—**P**, 3000 feet; **Q**, 2000; intermediate part from 1000 to 1500; **A**, 150; **E**, 300; **G** and **H** both about 100; the northern cliffs uniformly about 200; and the ridge **CD** rarely exceeds 300.

A bird's-eye view of the island may be annexed.

No. 2 Examination Paper, 1877.

Special.

[*Candidates are required to answer not less than the specified number of Questions in each Group.*]

Group A (TWO *Questions must be answered*).

(1). What is the general conformation of South Africa, and what are the chief data through which it has become known or inferred? Illustrate the shape of the country by a section at or about the latitude of Quillimane, showing the character of the underlying rocks.

(2). Draw a roughly-outlined Map of South Africa, containing a few of the principal names, on as large a scale as a page of the paper you are using will conveniently hold. Write thereon the elevations of the Plateaux, Lakes, and Mountains (not regarding units and tens of feet), and draw contour-lines of 1000, 2000, 3000, and 4000 feet respectively. Dot the Districts that receive excessive Rainfall with a blue pencil, and those that are arid with a red one.

(3). Describe the more prominent features and characteristics of the Lakes Tanganyika, Nyassa, Bangweolo, and Ngamì. In what direction is Lake Dilólo said to discharge its waters?

Group B (THREE *Questions must be answered*).

(4). Describe the Ocean-currents and prevalent Winds on the Eastern and Southern coasts of South Africa. How do the Currents affect the Sea Temperature of Table Bay and the Climate of the Coast of Namaqua Land?

(5). Give a short description of the Island of Madagascar, and point out its African affinities. Why was the Island of St. Helena peculiarly well adapted for the safe custody of Napoleon I. by the English?

(6). By what conditions are the Rains in South Africa mainly governed? What, approximately, is the amount and duration of Rainfall in the central districts between the Lualaba and the Zambesi; and what is it immediately to the south of the Victoria Nyanza? What is meant by the "Smokes"? Describe and explain the so-called "Table-cloth" of Table Mountain.

(7). What is the amount of Water poured into the sea, by each of the principal Rivers of South Africa? Compare the volume of the Lualaba at Nyangwe with that of the Congo at its mouth, and of the Nile at Gondokoro. What is the character of the Great Fish River and of the rivers in Namaqua Land and Damara Land generally?

(8). Which of the South African Rivers are in any sense navigable from the sea, and to what extent? What are the causes that usually limit the navigability of their lower portions? Describe the Falls of the Zambesi and of the Congo.

Group C (THREE *Questions must be answered*).

(9). What Domestic Animals are kept by the natives N. of the Zambesi? What Plants are grown by them? Where in those parts has the

Tsetze Fly been observed? What portion of the country S. of the Zambesi is entirely free from it?

(10). What, apparently, are the southern limits of the Equatorial Forest of dense vegetation? Give data for its determination.

(11). Mark on a rough Map the districts S. of the Zambesi where Copper, Gold, and Diamonds are respectively to be found. What indications of Gold are there in South Africa, N. of the Zambesi? Where is Katanga?

(12). Give a full Ethnological account of the Bushman and Zulu Races, describing their social conditions, occupations, dwellings, weapons and utensils of all kinds.

POLITICAL GEOGRAPHY.

No. 1 Examination Paper, 1877.

General.

[*Candidates are required to answer not less than the specified number of Questions in each Group.*]

Group A (THREE *Questions must be answered*).

(1). Explain in precise terms the meaning of Latitude and Longitude, and in general terms the methods of ascertaining each. State the difference between the Polar and Equatorial diameters of the Earth, and whether this sensibly affects the length of any degree of Latitude. At what parallel of Latitude is 1° of Longitude equal to half a degree of Latitude? If you cannot give an exact answer, give an estimate founded on your general knowledge of the Globe.

(2). State the Latitude and Longitude of Antwerp and Melbourne, of New Orleans and Hong Kong. What are the approximate distances in nautical miles between the former two places, by the Cape of Good Hope and Red Sea routes respectively; and between the latter two places? What land do sailing-vessels approach on each of these three courses?

(3). State the ordinary route and the distance between St. Petersburg and Khiva, and the principal Places, and geographical features of the country, on the route. Also between New York and San Francisco.

(4). Describe the chief ascertained differences, as regards Land and Water, between the Northern and Southern Polar Regions; the causes which have led to the greater exploration of the former; and the nearest approach (giving the exact position) hitherto made to each Pole; by whom, and when, made.

Group B (TWO *Questions must be answered*).

(5). Delineate the outline of the Black Sea, and of the Seas connected with it; and name the Provinces of the several Countries, and the principal Towns situated on their shores, starting Eastward from the Bosphorus.

(6). Give the Area and Population of the British Territory in India, and of each of the principal Native States constituting part of the British Empire in that Country, with the total area and population of the latter, and the Presidency to which they belong.

(7). State the Areas of the Mediterranean, Black, Caspian, Aral, and Baikal Seas, with their relative proportions, taking the area of the latter as the unit; name the principal Rivers flowing into each of the last four Seas, and their approximate length.

Group C (TWO *Questions must be answered*).

(8). Describe the principal changes made in the Boundaries of European States since the year 1815, and the order, and dates, of the Treaties by which they were made.

(9). Describe the Boundaries, and Extent, of the Russian Empire in Asia before the time of Peter the Great, and those of the several additions which have been made to it up to the present time.

(10). Enumerate the several Countries of South America, with the present nature of their Government, in the following Classes:

1. Those which are now under a foreign dominion, specifying the Countries to which they belong.
2. Those which were once, but have ceased to be, under a foreign dominion, distinguishing the Countries to which they formerly belonged.
3. Those which have never been under a foreign dominion.

Group D (TWO *Questions must be answered*).

(11). What are the chief lines of Overland Commerce between China and other parts of Asia; and what were the chief lines between China and Europe in the time of the Roman Empire? What Ports in China are now open to foreign trade?

(12). What Countries would be most affected by the construction of a Ship Canal across the Isthmus of Panama; and which Channel would, at present, be most valuable to the commerce of the world, that Canal, or the Suez Canal, giving the reasons for your opinion?

(13). How far does the local position of the Ports of Liverpool, Bristol, Hull, Glasgow, and Belfast, account for the rise and growth of the Trade of each?

Group E (THREE *Questions must be answered*).

(14). In what manner, and to what extent, have the various geographical conditions of the Continents of Europe and Africa promoted, or hindered, Civilisation within their respective areas?

(15). What have been the differences in the systems and results of Colonisation by the different nations of Europe within the last four centuries?

(16). Enumerate the principal, generally recognised, Types of the Human Race, and the Regions which they occupy throughout the globe. Describe the chief characters which distinguish them from one another.

(17). In what respects does the Continent of Australia differ from all the other continents? Into what Colonies is it divided, and how are their boundaries marked? In what respects does the population of each differ, as regards origin, present character, number, and employment?

(18). What climatic conditions appear to have been the most favourable to the development of primitive Civilisation, and how did their influences operate?

No. 2 EXAMINATION PAPER, 1877.

Special.

[Candidates are required to answer not less than the specified number of Questions in each Group.]

Group A (TWO *Questions must be answered*).

(1). State the Latitude and Longitude of Ascension and St. Helena. Crossing Africa from W. to E. on the parallel of each, name in their order the Port on the West Coast nearest to that Parallel; the principal features of the country; any considerable Native villages within a Degree of the parallel; and the Port nearest to it on the Eastern Coast. Name the travellers who have crossed Africa on, or near, either of these routes; the dates of their journeys; and the points on the coast between which they travelled.

(2). It has been proposed to run a line of Telegraph from Upper Egypt to Cape Town. What Route would be best from Victoria Nyanza to Delagoa Bay; and thence to each of the Eastern Termini of the existing lines of Telegraph in the Cape Colony (King William's Town and Kimberley), with reference to distance, to natural facilities or obstacles, and to the knowledge already acquired of the route? What would be the advantages of selecting the one or other terminus ?

(3). Name the Islands on the East Coast of South Africa. Describe their position, area, population, nationality, and language; present degree of civilisation; and connection, past and present, with one another.

Group B (TWO *Questions must be answered*).

(4). Describe the position, shape, and extent of Delagoa Bay; and its recommendations as a Harbour. Name the Countries which have claimed possession of it, and the time and circumstances of the last settlement of their claims. To what other Country would its possession be most valuable, and what would be the probable consequences of the establishment of a Free Port on its coast upon the existing trade of other ports in the neighbourhood?

(5). Which are the most important Rivers of South Africa, as regards (1) the area which they drain; (2) the extent to which they are navigable; and (3) the access which they afford to the interior, and the importance attaching to that access in each case?

(6). Give an account of the origin and growth of the Cape Colony, describing the additions made to its territory at different periods; its present territorial divisions; the circumstances, geographical or other, which have led to its extension, and influenced the direction of that extension; and those which now hinder its further extension in certain directions.

Group C (TWO *Questions must be answered*).

(7). State, as far as known, the order and date of the discoveries and settlement of each nation upon the Coast of South Africa; the extent of their explorations, and of their present possessions.

(8). Name the chief Native Races of South Africa; tracing them from W. to E.; their connection in groups; the derivation of their names; the chief languages spoken by them, and the vocal peculiarities for which any of them are noted.

(9). What have been the results of the occupation of each alien nation upon the indigenous population of South Africa; and what Tribes or Races have been brought under its influence?

Group D (TWO *Questions must be answered*).

(10). What have been the principal Ports on the E. and W. Coast of South Africa from which the Slave Trade has been carried on, and the routes from the interior by which, as far as is known, Slaves have been brought to each Port?

(11). Explain the geographical and climatic conditions which have influenced the establishment of European Colonies on the coasts of South Africa.

(12). What are the chief points of resemblance and difference, natural, political, and commercial, between the Colonies of the Cape and Natal; and to what results, upon the condition of each, have they led up to the present time?

The following are the names of the successful competitors:—

PHYSICAL GEOGRAPHY.

		Age.	
Gold Medal	WALTER NEW	17	*Dulwich College.*
Bronze Medal	ARTHUR SMYTH FLOWER	16¾	*Winchester College.*

Honourably Mentioned.

	Age.	
JOHN CHISMAN	17¼	*City of London School.*
J. A. ROBINSON	18	*Liverpool College.*
FRANK STANTON CAREY	16½	*Bristol Grammar School.*

POLITICAL GEOGRAPHY.

		Age.	
Gold Medal	WILLIAM JOHN NEWTON	16	*Liverpool College.*
Bronze Medal	JOHN WILKIE	17	*Liverpool College.*

Honourably Mentioned.

	Age.	
ARTHUR REED ROPES	17	*City of London School.*
WILLIAM WALLIS ORD	17	*Dulwich College.*
SAMUEL FOWLER BLACKWELL	16	*Clifton College.*
GEORGE ARNOLD TOMKINSON	17¼	*Haileybury College.*
HENRY COLTHURST GODWIN	18	*Clifton College.*

REPORTS OF THE EXAMINERS FOR 1877.

I.—PHYSICAL GEOGRAPHY.

To the Council of the Royal Geographical Society.

March 26th, 1877.

I HAVE no hesitation in making my awards, because the merits of the candidates appear to be clearly graduated, and the Medallists to be well worthy of their respective honours.

Gold Medallist ..	WALTER NEW, Dulwich College.
Bronze Medallist ..	ARTHUR SMYTH FLOWER, Winchester College.

Honourably Mentioned.

JOHN CHISMAN, City of London School.
JOHN ROBINSON, Liverpool College.
FRANK STANTON CAREY, Bristol Grammar School.

The candidates came from twelve different schools, and were twenty-two in number. I consider their performances to be, on the whole, very creditable to their age and opportunities.

The Papers of the Gold Medallist, Walter New, are extraordinarily good; in style and grasp he is much superior to the other candidates. He obtained the Bronze Medal in 1876, and, on referring to the report then made by the Examiner on his performance, I feel sure he must have greatly advanced during the past year in his geographical knowledge.

The answers of the Bronze Medallist, Arthur Smyth Flower, are sound and judicious, and, though they are brief, they afford ample evidence of a wide range of solid information.

There is a great deal to praise in the answers of the three boys whom I have Honourably Mentioned. Chisman was placed below the Bronze Medallist because he had not sufficiently mastered the special subject. Robinson, whose replies were written with unusual fulness, had seriously infringed the conditions of the Examination, by attempting only one question instead of the three that were required in the first group, and by neglecting altogether the one question that was required in the last group. Carey, though generally good, was not equal on the whole to those I have already mentioned.

As regards the remainder of the candidates, I find seven who are nearly, but not quite, in my opinion, deserving of Honourable Mention. Then follow eight whose performance is of a decidedly lower level. Lastly, there are two, whose work is so meagre and bad, that I am surprised at their having been entered as candidates.

It will give a fair idea of the performance of the seventeen boys who have not obtained distinction to say that, although most of the questions required thought as well as knowledge to answer, it would be possible to extract from their aggregate replies very good answers to about three-fourths of them. On the other hand, a large collection of imperfect work and of gross errors might be extracted from the same sources.

I have the pleasure to add that some of the boys drew very effective rough diagrams as illustrations of what they desired to convey.

I will point out some common defects in the knowledge of the candidates in an Appendix to this Report, for private transmission to the competing Schools, and for the guidance of future Examiners.

The experience of this Examination induces me to recommend that Problem Questions, perhaps more or less similar in form to that of Question 6 in the General Paper, should be invariably set. They afford a far shrewder test of geographical knowledge, in its broadest and most liberal sense, than the reproduction of mere book-work. Every candidate would be able to make some reply to them, and only the best among the candidates would be able to give really good and comprehensive answers. Besides this, they much interest boys. Probably the future of Geography as a recognised subject of instruction in the higher forms of Schools and in Universities depends very much on the degree to which it may be possible to set problems in it; and I think that it would be well to suggest to future Examiners that they should always endeavour to do so.

FRANCIS GALTON.

II.—POLITICAL GEOGRAPHY.

To the Council of the Royal Geographical Society.

WOMBWELL HALL, GRAVESEND,
March 30th, 1877.

GENTLEMEN,

The number of candidates for the Prizes in Political Geography was twenty, coming from thirteen schools. In each of the two preceding years it was nineteen. In 1874 it was only twelve.

The successful competitors are :—

1. **Gold Medal** .. .. WILLIAM JOHN NEWTON, Liverpool College.
2. **Bronze Medal** .. JOHN WILKIE, Liverpool College.

Honourably Mentioned.

ARTHUR REED ROPES, City of London School.
WILLIAM WALLIS ORD, Dulwich College.
SAMUEL FOWLER BLACKWELL, Clifton College.
GEORGE ARNOLD TOMKINSON, Haileybury College.
HENRY COLTHURST GODWIN, Clifton College.

The Gold Medallist competed last year for the same Prize, and was Honourably Mentioned. The Bronze Medallist carried off the Gold Medal for Physical Geography. Both, therefore, have already distinguished themselves, and the Papers of both on this occasion are of marked excellence.

They have run very close together. I have had to take considerable pains to ascertain their relative merit. In justice to Wilkie, I would mention that, out of twenty-one questions which both the candidates answered, he gained a majority of marks; but while he answered only one question which the other did not touch, Newton answered six which the former did not attempt, and among them were two of the most difficult, which Newton answered remarkably well. Both, however, acquitted themselves most creditably.

I would apply to both the language in which Professor Rupert Jones reported on Wilkie's Prize Paper last year: "Their Papers are clear, systematic, and comprehensive, showing a good general knowledge of" (on this occasion Political) "Geography, and a good special knowledge" of the subject of the Second Paper.

The first two of those Honourably Mentioned are nearly equal, and are sufficiently near to the Medallists to deserve special credit for their work. The other three are also pretty equal to one another, but they follow the others at a wider distance.

Among the latter, one did not strictly comply with the conditions, as he failed to answer the required number of questions in one group; but it is deserving of notice that this new condition was complied with by all the other candidates whose Papers are entitled to Honourable Mention.

In passing the questions I was guided by the nature of those set on the last three occasions, and by opinions which I received of the characters of the answers given. But I am led by the results of the present Examination to the conclusion that, while the present conditions as regards the number of questions, and the time allowed for answering them, afford a good test of the scope and extent of the candidates' studies in Geography, they scarcely admit of their answering them with the desired precision; and the Examiner may sometimes find it difficult to distinguish between the efforts of an overpressed or hurried memory, and the random guesses of superficial or deficient knowledge.

Last year Sir Leopold McClintock reported that "it appears deserving of consideration whether fewer questions requiring more precise answers, or whether a little more time to answer them in, would not more satisfactorily test the knowledge of the candidates;" and in the preceding year your President, Sir Rutherford Alcock, stated that he "joined in the recommendation of his predecessor, Professor Rawlinson, as to the desirability of more exactness in the knowledge acquired, and the avoidance of any random use of figures." I do not think that the number of questions should be reduced, as they afford a good test of the scope of the candidates' reading, and give them a reasonable degree of selection; but the time might be enlarged, if more than one day could be given to the examination.

Perhaps the experience of some of the past Medallists might be advantageously consulted as to the means of more effectually testing the precision, as well as the general knowledge, of the candidates.

RAWSON W. RAWSON.

PROGRAMME FOR 1878.

THE Council of the Society have satisfaction in repeating the offer of Prize Medals for the ensuing year; the Second Medal to be Silver, instead of Bronze as heretofore. They have invited the following Public Schools to take part in the competition:—

List of Schools invited to compete in 1878.

English Schools.—St. Peter's College, Radley, Abingdon; King Edward's School, Birmingham; Brighton College; Bristol Grammar School; Cathedral Grammar School, Chester; Cheltenham College; Clifton College; Dulwich College; Eton College; Haileybury College; Harrow; Hurstpierpoint; Liverpool College; Liverpool Institute; London,—Charter House; Christ's Hospital; City of London School; King's College School; St. Paul's; University College School; Westminster School; Royal Naval School, New Cross;—The College, Malvern; Manchester School; Marlborough College; University School, Nottingham; High School, Nottingham; Repton; Rossall; Rugby; King's School, Sherborne; Shoreham; Shrewsbury; Stonyhurst College, Blackburn; The School, Tonbridge; Uppingham School; Wellington College; Winchester College.

Channel Islands School.—Victoria College, Jersey.

Scotch Schools.—Aberdeen Grammar School; Edinburgh Academy; Edinburgh High School; Glasgow High School; Glasgow Academy.

Irish Schools.—Royal Academical Institute, Belfast; Dungannon Royal School; Ennis College; Portora Royal School, Enniskillen; Foyle College, Londonderry; Rathfarnham, St. Columba's College; Rathmines School, Dublin.

Syllabus of Examinations for the Prize Medals of the ROYAL GEOGRAPHICAL SOCIETY *in* 1878.

EXAMINATION IN PHYSICAL GEOGRAPHY.

This Examination will take place simultaneously at the several invited Schools, according to printed regulations (which will be forwarded in due time), on the fourth Monday in March, 1878, and will consist of two papers of three hours each; the one to be answered between 9 and 12, 9½ and 12½, or 10 and 1 A.M. (according to the convenience of the School); and the other between 2 and 5, 2½ and 5½, or 3 and 6 P.M.

N.B. It is necessary, in order that Candidates may be admitted to the Examination, that their names be sent in to the Secretary of the Society on or before the *first* Monday in March.

No. 1 *Examination Paper* will consist of questions on the following subjects:—

A. *Configuration of the Earth*, as learnt by careful study of a globe. What are the distances, speaking roughly, between such remote places as may be specified? What places of importance lie on the direct lines between them, and what is the section along each? What are the relative size, elevation, &c., speaking roughly, of such well-known districts, mountains, and rivers, as may be specified?

B. *General Physical Geography.*—Distribution of land and sea, forests, plateaux, glaciers, volcanoes, man, animals, plants and minerals; climates and seasons; oceanic, meteorological and magnetic phenomena.

⁂ Extra marks will be allowed for sketches, but only so far as they are effective illustrations of what cannot otherwise be easily expressed. The use of blue and red pencils is permitted for this purpose. No marks will be given for neatness of execution, apart from accuracy. Some of the questions will be framed so as to make illustrations by sketches obligatory.

The candidates may be required to construct a rough map without the aid of special instruments, from a brief description of a district illustrated by itineraries and bearings.

No. 2 *Examination Paper* will consist wholly of questions on a special subject.

The special subject appointed for 1878 is—

THE BASIN OF THE NILE, AND THE PORTION OF AFRICA THAT LIES TO THE EAST OF IT.

EXAMINATION IN POLITICAL GEOGRAPHY.

This Examination will take place simultaneously at the several invited Schools, at the same hours and under precisely the same regulations as those in Physical Geography.

No. 1 *Examination Paper* will consist of questions on the following subjects:—

A. *Descriptive Geography.*—Explanation of latitude and longitude. What are the distances in geographical miles, speaking roughly, and as learnt by the careful study of a globe, between such remote places as may be specified? What places of importance lie on the direct line between them? What is the relative size, speaking roughly, of such well-known countries, mountains, and rivers, as may be specified?

B. *Historical Geography.*—Embracing (1) the boundaries of states and empires at different historical periods; (2) the chief lines of commerce, ancient and modern; (3) the influence of geographical features and conditions upon the distribution of races and political history of mankind.

⁂ Extra marks will be allowed for maps and sketches, but only so far as they are effective illustrations of what cannot otherwise be easily expressed. The use of blue and red pencils is permitted for this purpose. No marks will be given for neatness of execution, apart from accuracy. Some of the questions will be framed so as to make illustrations by sketches obligatory.

The candidates may be required to construct a rough map without the aid of special instruments, from a brief description of a district illustrated by itineraries and bearings.

No. 2 *Examination Paper* will consist wholly of questions on a special subject.

The special subject appointed for 1878 is—

THE BASIN OF THE NILE, AND THE PORTION OF AFRICA THAT LIES TO THE EAST OF IT.

Candidates will be expected to be acquainted with the History of Geographical Discovery in the Nile Region.

The following books contain much information regarding the Physical and Historical Geography of the Nile Basin and Countries lying to the East of it:—

1. 'Herodotus,' Book II. Rawlinson's Edition. Vol. II. London: Murray.
2. 'Claudius Ptolemy and the Nile.' By W. D. Cooley. London: Parker and Son. 1854.

3. 'Handbook for Travellers in Egypt.' London: Murray.

4. 'Reisen in Nubien, Kordofan,' &c. By E. Rüppell. 1829.

5. 'Travels in Nubia.' By J. L. Burckhardt. 1819.

6. 'Travels to Discover the Source of the Nile in 1768–1773.' By James Bruce.

7. 'The Nile Tributaries of Abyssinia.' By Sir S. W. Baker. London: Macmillan.

8. 'History of the Abyssinian Expedition.' By C. R. Markham. London: 1869.

9. 'The Heart of Africa.' By Dr. Schweinfurth. London, 1874.

10. 'Journal of the Discovery of the Source of the Nile.' By Captain J. H. Speke. 1863.

11. 'The Albert Nyanza, Great Basin of the Nile.' By Sir S. W. Baker. London: Macmillan.

12. 'Summary of Observations on the Geography, &c., of the Lake Region of Equatorial Africa.' By Colonel J. A. Grant. 'Journal' R. G. S., Vol. XLII.

13. 'Reise in das Gebiet des Weissen Nil.' By Th. von Heuglin. Leipzig, 1869.

14. 'Notes to accompany a Survey of the White Nile.' With Map. By Colonel C. G. Gordon. 'Journal' R. G. S., Vol. XLVI., p. 431.

15. 'Stanley's Exploration of the Victoria Nyanza.' By Colonel J. A. Grant. 'Journal' R. G. S., Vol. XLVI., p. 10.

16. 'Egypt, the Soudan, and Central Africa.' By J. Petherick. 1861.

17. 'Journey through the Afar Country.' Munzinger, 'Journal' R. G. S., Vol. XXXIX.

18. 'The Highlands of Ethiopia.' By Sir W. C. Harris. 3 Vols. London, 1844.

19. 'First Footsteps in East Africa; or, an Exploration of Harar.' By Captain R. F. Burton. London, 1856.

20. 'Reisen in Ost Africa.' By Baron C. C. von der Decken. Leipzig, 1869–70.

21. 'Geographical Notes of an Expedition to Mount Kilima-ndjaro.' By Baron C. C. von der Decken. 'Journal' R. G. S., Vol. XXXIV.

22. 'Travels, Researches, &c., in Eastern Africa.' By J. L. Krapf. London, 1860.

23. 'Life, Wanderings and Labours in East Africa.' By Rev. C. New. London, 1874.

⁂ In accordance with a recent Minute of the Council, the Libraries of competing Schools can be furnished with the Volumes of the Society's 'Journal' at the rate of 15*s.* each for past, and 7*s.* 6*d.* for the present and future years.

AFRICAN EXPLORATION FUND.

AFRICAN EXPLORATION FUND.

JULY 1877.

PATRON, H.R.H. THE PRINCE OF WALES.

DURING the month of June in the present year the following Circular was issued to all Fellows of the Society, and to others likely to sympathise with its objects. The motives which induced the Council to take the important step thus announced are set forth in the commencing paragraphs of the Minute, forming the Appendix to the Circular.

CIRCULAR

BY THE SPECIAL COMMITTEE APPOINTED BY THE COUNCIL OF THE ROYAL GEOGRAPHICAL SOCIETY TO ADMINISTER THE AFRICAN EXPLORATION FUND.

THE Council of the Royal Geographical Society have considered it a duty, on grounds fully explained in the Minute appended to this Circular, to take their appropriate part in the present great movement to lay open the whole interior of Africa to civilisation and European commerce.

They have accordingly appointed a Special Executive Committee, with authority to announce the formation of an African Exploration Fund, entirely separate from the general income of the Society, towards which they have contributed a first grant of 500*l.*, to initiate a national undertaking for the systematic and continuous exploration of Africa.

Geographical investigation is the only part of the larger scheme of civilisation that falls within the special field of the Royal Geographical Society; but being a preliminary step to ulterior ends, it commends itself to the sympathy of many who are not geographers. A vast waste of effort, life, and money will be avoided in the future prosecution of philanthropic and commercial operations in Africa, if the Physical and Political Geography of its interior be previously well determined. When the best routes have been clearly ascertained, we may hope that it will not be long before wagon roads—if not railways and telegraphic lines—will follow, tending gradually to the extinction of the slave-traffic, which now depopulates some of the richest and most productive territories to be found in any part of the world.

The attainment of adequate geographical knowledge is, however, a task of no ordinary magnitude and cost, and the requisite means, being far in excess of those now at the disposal of the Royal Geographical Society, cannot be obtained except through an appeal to the public.

The accompanying Sketch-Map* has been designed to show at a glance, by the names inscribed on the routes traversing Africa in numerous directions, how large a portion of the great Continent, so far as priority of discovery is concerned, has been appropriated by British travellers. It is true they have not been alone in the great work; but the large share in the exploration of those parts of Africa to which public attention is now specially directed that may be claimed by Livingstone, Burton, Speke, Grant, Baker, Gordon, and lastly Cameron, all British subjects, will readily be traced. What these have so well begun, it is now desired to complete.

It must be borne in mind that steam navigation is bringing Eastern Africa into close communication with Europe. The mail services recently established, and likely to be further developed, touch at various ports in Eastern Africa, and cannot fail to stimulate European commerce with the interior, by affording increased facilities of intercourse.

A trade has existed since a very ancient period between the opposite shores of India and Africa; and it must be of importance that all hindrances to its increase should be removed. A great development of enterprise along the Eastern coast may also be expected on the side of our South African Colonies, if the productive regions of the interior be opened up. The proposed scientific exploration of the capabilities of Africa, and the discovery of the best means of reaching its interior from the Eastern coast, will be a most serviceable step in this direction.

In the appended programme of routes suggested for exploration or more careful examination, it is not to be assumed that the Committee bind themselves to these, as necessarily the best or the only ones to be adopted, even at the present moment. Before finally determining the details of any proposed Expedition, the Committee will make it a practice of seeking information from the principal

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* Issued with the original Circular.

African geographers and travellers, many of whom are already Fellows of the Royal Geographical Society.

It is not proposed by the Committee to confine their operations to the furtherance of Expeditions under their entire control. They will be willing to consider the propriety of assigning a grant in aid to secure good geographical results from any Expedition, missionary or commercial. It will be their endeavour to collect and diffuse the latest geographical information; to procure its early discussion before the Royal Geographical Society; to point out the more immediate desiderata in African Geography; to prevent waste of effort in desultory or unimportant explorations; and to turn the large resources of the Society in books and instruments, and especially in the willing services of its Fellows who are authorities on African matters, to helpful account.

In such a work the Fellows of the Royal Geographical Society are sure to sympathise; and to them, in the first instance, as a large and influential body, the Committee would appeal, to further, by subscriptions or donations, no less than by their influence throughout the country, the objects contemplated.

The Committee are confident that the public generally will not be asked in vain for means to prosecute with vigour such explorations as may promote objects, which history shows to have enlisted on many occasions the warmest sympathy of the Nation.

They would say in conclusion that, in seeking to promote a national undertaking which may assume very large proportions, they propose to begin with such funds as they have in hand, and to persevere to the extent which these and further contributions will allow. The difficulties to be anticipated in efforts to civilise Africa must not be underrated, considering how large has been the proportion of unsuccessful attempts. But they feel convinced that persistent and simultaneous explorations from many sides, and of a scientific character, offer the best hope of ultimate success.

The object of the present Circular is to invite public attention to the subject, and to afford an opportunity to those who are already interested in African Exploration, or may from various considerations desire to promote its systematic prosecution, to come forward and give such pecuniary support to the Committee as will enable them to work with adequate means, and without interruption, until the necessary information is obtained.

RUTHERFORD ALCOCK, *Chairman*.

H. W. BATES, *Secretary to the Committee.*

1, Savile Row, London, W.
May 16, 1877.

Routes in Eastern Africa that have been suggested for Exploration or careful Examination.

1st. From the Gold Fields in South Africa, past the south end of Lake Tanganyika, to Unyanyembe.

2nd. Along the East face of the coast range, between the Zambesi and the Equator.

3rd. From the East coast to the north end of Lake Nyassa.

4th. Between the north end of Lake Nyassa and the south end of Lake Tanganyika.

5th. From the coast opposite Zanzibar to the south end of Lake Victoria; thence to the north end of Lake Tanganyika.

6th. From Mombasa, by Kilimandjaro, to the south-east shore of Lake Victoria.

7th. From Formosa Bay along the valley of the River Dana, by Mount Kenia, to the north-east short of Lake Victoria.

No. 1 *Route. Gold Fields to Unyanyembe.*—This route would cross the Zambesi above Tete, and would connect the furthest point reached by Baines (17½° S. lat. and 30½° E. long.) with Livingstone's route in 1866–67. In its entire length it extends through twelve and half degrees of latitude, and it leads along the high land that separates the three lakes, Bangweolo, Nyassa, and Tanganyika; a healthy hilly country from 4000 to 6000 feet above the sea-level. It is of much consequence that the character of the people, and the products of the land, as well as the physical features of the whole of the country traversed by this route, should be fully ascertained. If all these prove to be favourable to the undertaking, a line of overland telegraph might be opened from Cape Town, through the Gold Fields to Unyanyembe, and thence in time to Egypt and Europe.

No. 2 *Route. Exploration of the Eastern face of the Coast Range.*—We only know this at intervals, where it has been crossed by a few travellers—mostly at the same "passes." The contours of the range should be explored either from the sea-face or from the plateau side, with the view, first, of determining the points where the range is nearest to the sea, as it is of material importance to get quickly away from the unhealthy coast to higher and consequently healthier regions; secondly, with the view of finding the most convenient lines of access to the interior.

No. 3 *Route. From the Eastern coast to the North end of Lake Nyassa.*—Portions of the district to be traversed by this route were visited by Dr. Roscher and Baron von der Decken, and more recently by Bishop Steere. There appears to be a natural highway across it, through which slave-caravans have travelled for many years. A route from the East coast to the North end of Nyassa would be important as a main line, whence connections might hereafter be made with the South end of that lake, and with the South end of Lake Tanganyika.

No. 4 Route. From the North end of Nyassa to the South end of Tanganyika.—Livingstone crossed this route in 1872, but beyond this we are almost entirely ignorant of its nature. It would connect two great lakes, on one of which a Missionary Station is already established, and it would solve many vexed geographical questions, one of which is the real distance between the lakes. It would be important to learn the capabilities of the country for a wagon-road to connect Tanganyika with the anticipated trading depôt at the north end of Nyassa.

No. 5 Route. From opposite Zanzibar to Lake Victoria and the North end of Tanganyika.—The Church Missionary Society have established a station this year at M'papwa, 200 miles from the coast, and their parties for Karagwe and Uganda will probably be at their destinations by Midsummer. The experiences of the Rev. Roger Price, of the London Missionary Society, have shown that the tsetze fly did not injure cattle last year on the route to M'papwa; and Mr. Price reports so favourably upon the physical features of this portion of the country, that a large party are now being equipped with bullock-carts, in which they are to proceed to Ujiji. It is proposed, however, to explore a nearer way to Lake Victoria than that by M'papwa. The western third of the route, extending from the south point of Lake Victoria to the north end of Tanganyika, is as yet untraversed by Europeans, and lies across the high land that appears to divide the Nile from the Congo.

No. 6 Route. From Mombasa, by Kilimandjaro to the South-east Shore of Lake Victoria.—We know but little of this route through the travels, reports, and hearsay of Dr. Krapf, Baron von der Decken, and the Rev. Messrs. Wakefield and New, as none of these gentlemen have penetrated further than the snow-capped mountain Kilimandjaro (about 19,000 feet in height). It is a long-established caravan-route, and leads in a direct line to the south-east shore of Lake Victoria.

No. 7 Route. From Formosa Bay, by the Dana River and Mount Kenia, to the North-east Shore of Lake Victoria.—This route passes through a mountainous country, and may therefore be expected to be subject to no great heat or malaria, although it lies only 2°

south of the Equator. The district it traverses is certainly well watered, and is probably fertile. The late Captain Speke strongly recommended a route from east to west at 1° north of the Equator, but the one already mentioned is shorter, and has at least equal advantages. The River Dana has been found to be navigable for 100 miles, and might prove to be so for many more. Dr. Krapf reports that it was 7 feet deep at 50 miles to the east of Mount Kenia, but that it was rocky. It is said that the Samburo people, to the north, employ camels and horses; if this report be true, the explorer or trader would be independent of porters. This route has many recommendations: the famous Mount Kenia, capped like Kilimandjaro with snow, lies on the way, and the earlier portion of the journey might be made by water.

In addition to these specific lines of exploration, and in connection with a trunk-road across the Continent, efforts should be made to explore the great extent of unknown country to the north of the Lualaba, so as to connect Equatorial Africa with Darfur, with Lake Tchad, and with the valley of the Ogowé.

The Committee may also have to indicate to their travellers convenient places of rendezvous—such as Ujiji, on Lake Tanganyika, and Nyangwé, on the Lualaba, with others to be fixed hereafter—in the respective dominions of the Casembé, the Kassongo, and the Muata Yanvo. Nyangwé, as being at present the most advanced post of African exploration, is especially important as a depôt.

Other measures might be suggested to be carried out when favourable opportunities should occur, such as to place a steamer on the Congo above the falls, for purely exploratory purposes.

A comparison has been made of the length of each journey in Africa, in a few recent instances, with the cost of making it. It appears that the total expense of despatching a well-equipped exploratory Expedition from England may be roughly reckoned at the rate of 1*l.* 10*s.* for each geographical mile of country travelled over in Africa, supposing the Expedition to return to the place whence it set out. In through journeys, the rate is, in many cases, nearly twice as great. The aggregate length of the seven specified routes is about 7700 geographical miles; consequently, the total cost of the proposed Explorations, at the above rate, would amount to about 11,550*l.* It is needless to dwell on the fact that this is an exceedingly rough estimate; nevertheless, it serves to give some useful idea of the expense contemplated. The annexed Table enters more into detail:—

Route.	Approximate Distance in Geographical Miles.	Cost, if reckoned at £1 10s per Mile.
		£
1. Goldfields to Unyanyembe, and back .	2000	3000
2. East Coast Range, Zambesi to Equator* ..	1400	2100
3. East Coast to North of Nyassa and back ..	500	750
4. North of Nyassa to Tanganyika, and back†	400	600
5. Zanzibar to Lake Victoria and Tanganyika, and back	1600	2400
6. Mombasa by Kilimandjaro to Lake Victoria, and back	900	1350
7. Formosa Bay by Kenia to Lake Victoria, and back	900	1350
	7700	£11,550

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* This is a through route, but its cost is estimated at a single rate.

† If conducted independently from Lake Nyassa, and not in connection with Route 3, the cost would be increased.

APPENDIX.

MINUTE OF COUNCIL, *March 12th*, 1877.

1. THE Council of the Royal Geographical Society, being of opinion that the time has arrived when it becomes their duty to organise means for the systematic and continuous exploration of Africa, and recognising with sympathy and admiration the enlightened efforts of the King of the Belgians to give a new impulse to such exploration;—desiring, moreover, that the work it is proposed to carry out should be in harmony with the views of His Majesty, and of societies established in other countries for the purpose of exploration and new discovery,—resolve to spare no efforts to endeavour, by friendly interchange of information and assistance, to combine the energies and sympathies of all the civilised nations of the world in furtherance of the object which the King and the Geographical Society alike are desirous of promoting.

2. Looking, however, at the subject from a practical point of view, the Council of the Geographical Society are of opinion that

African Exploration will be more effectually prosecuted by England, and the necessary funds more readily obtained, through national enterprise than by international association.

3. The Council, therefore, in view of these considerations, propose, as the best course of action for the Royal Geographical Society, to assist in the establishing of a national fund, to be called the "African Exploration Fund."

4. The fund to be appropriated to the scientific examination of Africa (especially the central part of that continent) in a systematic and organised manner, with a view to the exploration of the regions yet unknown to civilised Europe, the attainment of accurate information as to climate, the physical features and resources of the country, the character of the inhabitants, the best routes of access, and all such other matters as may be instrumental in preparing the way for opening up Africa by peaceful means.

5. The Council propose that the African Exploration Fund should be kept entirely separate from the general income of the Society, and that the contributions annually made by the Society itself should from time to time to time be carried over to the account of the Fund. To secure the appropriation of the Fund to the special objects for which it is raised, the Council of the Geographical Society will name out of their body a Special Executive Committee, whose duty it will be, subject to the control of the Council, to see that the explorations set on foot are conducted in such a systematic manner as to prevent a wasteful expenditure of money or energy in repeating the investigation of places or subjects which have already been sufficiently investigated by British or foreign explorers, or in undertaking expeditions which other Societies may have already projected and be prepared to carry out in a satisfactory manner.

6. The Executive Committee will have authority to announce the formation of an African Exploration Fund, with the above-named objects; invite the support and co-operation of the public, and of any branch associations or committees already formed, or which may hereafter be constituted, in the United Kingdom or the Colonies, and generally to take such steps as may seem necessary for promoting the establishment of the African Exploration Fund and carrying into effect its objects.

7. Subject to the confirmation of the Council of the Geographical Society, and to any special rules for their guidance that may from time to time be laid down, the Committee will make regulations for the conduct of their proceedings, and generally in relation to any other matter which may be required to be provided for the establishment of the African Exploration Fund and the carrying

its objects into effect, provided the regulations so made are not inconsistent with the above-mentioned provisions.

8. The Council of the Royal Geographical Society will from time to time, and at least once in each year, summon a meeting of the subscribers to the Fund, for the purpose of explaining the progress made in exploration, the mode in which the Exploration Fund is being dealt with, and ascertaining, as far as practicable, the views of the subscribers in relation to such Fund.

9. The subscribers of one pound and upwards will be entitled to receive copies of any reports or proceedings published by the Committee. The Royal Geographical Society retain the right of priority of publication of any maps, geographical reports, or other similar information furnished by explorers supported by the Fund, but copies of such published reports will be sent in exchange to all national and local societies, whether British or foreign, constituted for the objects of the African Exploration Fund.

10. The Treasurer and Bankers of the Royal Geographical Society will act on behalf of the African Exploration Fund, opening a separate account under that head.

11. H.R.H. the Prince of Wales has, at the request of the Council of the Royal Geographical Society, signified his pleasure that he will allow his name to be associated with, and accept the office of Patron of, the African Exploration Fund.

12. The following Members are nominated as constituting the Executive Committee of the African Exploration Fund :—

The PRESIDENT of the SOCIETY for the time being,
Sir HARRY C. VERNEY, Bart.,
Sir C. FOWELL BUXTON, Bart.,
Sir RAWSON W. RAWSON, K.C.M.G., C.B.
Colonel J. A. GRANT, C.B., F.R.S.,
General C. P. RIGBY,
FRANCIS GALTON, Esq., F.R.S.,

and the *ex-officio* Members of the Committee.

13. The sum of 500*l.* will be carried over from the funds of the Society to the separate account of the African Exploration Fund.

Donations and Annual Subscriptions to be paid to the Chief Clerk of THE ROYAL GEOGRAPHICAL SOCIETY, 1, *Savile Row, W., or to Messrs.* COCKS, BIDDULPH, & CO., 43, *Charing Cross, London, S.W., to the Credit of the* AFRICAN EXPLORATION FUND. *The Subscription List will be printed hereafter on a detached flyleaf.*

The fresh impulse to African Exploration stated in the foregoing Circular as forming the ground for the establishment of the African Exploration Fund, originated in the Conference at Brussels on the 12th, 13th, and 14th of September last, to which His Majesty the King of the Belgians invited a number of the leading geographers of the chief nations of Europe. Representatives from Germany, Austro-Hungary, Belgium, France, Great Britain, Italy, and Russia were present at the Conference, and, as a result of their deliberations, it was agreed that an International Commission, having its seat at Brussels, should be founded for the exploration and civilisation of Central Africa, and that each nation willing to co-operate should form national Committees to collect subscriptions for the common object, and send delegates to the Commission; thus centralising as much as possible the efforts made, and facilitating by co-operation the execution of the resolutions of the Commission.

Belgium was the first to establish a National Committee, the members of which assembled under the Presidency of the King on the 6th of November, 1876. At this meeting the statutes were formulated and agreed to, the preamble of which set forth that the Committee was constituted for the purpose of carrying into effect, within the limits of Belgium, the programme of the International Conference, which was stated to be the " repression of the slave-trade and the exploration of Africa." The Committee made an appeal to the Belgian public for subscriptions, with considerable success.

In England, when the organisation of a similar Committee came to be discussed, difficulties of an obvious nature were foreseen, which rendered it desirable that such a Committee, whilst maintaining friendly relations of correspondence with the Belgian and other Committees, should not trammel itself with engagements of an International nature, or with objects other than those connected with Geography. The constitution and programme of the Committee was thereupon arranged, as set forth in the foregoing Circular. In consequence of this decision, delegates have not been appointed to the International Commission at Brussels.

Germany.—In response to the views of the Brussels International Conference, a National Committee was formed at Berlin who decreed on the 18th of December, 1876, the establishment of the GERMAN AFRICAN SOCIETY, the functions of which will be to carry out the same objects as the International Commission, viz., 1. The Scientific Exploration of the unknown regions of Central Africa; 2, the opening up of Central Africa to civilisation and commerce; and 3, as ulterior object, the extinction of the slave-trade. The affairs of the Society are to be administered by a Council, of which Prince Henry VII. Reuss is the President, Dr. George von Bunsen the Secretary, and Dr. Nachtigal, Herr Delbrük, Dr. A. Bastian, Dr. Herzog, Baron von Richthofen, Dr. Roth, and Dr. W. Siemens, the members. The Society will maintain relations with the International Commission at Brussels, and have appointed Dr. Bastian, Dr G. von Bunsen, and Baron von Richthofen as German Delegates.

The Society is to consist of Founders and Members, the former comprising those who contribute a donation of 300 marks to its funds, the latter to include all annual subscribers of 5 marks and upwards—all corporations, chambers, and Scientific Societies to be admissible in their corporate capacities as members, on payment of proportionate subscription.

As to the disposal of the Funds accumulated by the Society, it has been decided that only a portion of the yearly income shall be contributed to the International Commission, the remainder and greater part being set apart for German undertakings of Discovery and Exploration in Africa. Like the Belgian Commission, a leading feature of the German operations will be the foundation of stations in the interior of Africa, which are to serve partly as bases of operations for travellers, and partly as centres for the spread of civilisation and commerce.

Belgium.—The "International Commission of the African Association" met, on the invitation of the King of the Belgians, at Brussels on the 20th and 21st of June last; His Majesty presiding. Delegates from all the nations represented at the Conference of September 1876 attended, with the exception of Great Britain and Russia, the National Russian Committee excusing the absence of their delegates on the ground of their being much occupied with work entrusted to them by their Government. Delegates from the Netherlands attended the Meeting for the first time. Various subjects of detail were discussed during the two days' sittings; amongst them the choice of a flag for the Association, and the question of procuring reductions of passage money, and so forth, in favour of Members of Expeditions, from the various steamboat and trading companies connected with African seaports. With regard to this latter subject, it was announced by Signor Adamoli (Italian Delegate), that the Italian Government had made it a stipulation in its contracts with Navigation Companies that passages at a reduced rate shall be granted to all Members of Scientific Expeditions. A Netherlands delegate (M. Versteeg), also announced that the Directors of the *Afrikaansche Handels vereeinging* *te Rotterdam* had agreed to convey baggage intended for the various Expeditions free of charge, and to grant hospitality in their factories to the Members of the Expeditions.

A statement of the Financial position of the Association at this date was read by the Secretary, by which it appeared that the Belgium National Committee had already paid over to the Central Commission 287,000 francs in donations, and 44,000 francs in annual subscriptions, totals which the Committee has promised to increase during the current year by 11,000 francs and 58,000 francs respectively. The donations and a portion of the annual subscriptions are to be invested and the interest only expended in the objects of the Association ; in this way, according to the calculation of the Treasurer, 73,000 francs will be at the disposition of the Executive Committee for the year 1877. The immediate commencement of operations has accordingly been decided upon; and an Expedition is to be despatched by way of Zanzibar towards Lake Tanganyika, with the object of establishing stations either at the Lake itself, or at certain points beyond it; and also of sending Explorers who will make these stations their basis of operations. The drawing-up of detailed instructions is confided to the Executive Committee appointed to direct the operations of the Association.

Other Countries.—National Committees to co-operate with the Belgian International Commission are stated to have been formed also in FRANCE, President, Count de Lesseps; AUSTRO-HUNGARY, President, the Archduke Rudolph; ITALY, President, the Prince de Piedmont; SPAIN, President, the King; SWITZERLAND, President, M. Bonthelier de Beaumont; RUSSIA, President, the Grand Duke Constantine; HOLLAND, President, the Prince of Orange; and PORTUGAL, President, the Duke de San Januario.

The Austro-Hungarian Committee has made a first contribution to the funds of the Brussels Commission of 5000 francs.

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PROCEEDINGS

OF

THE ROYAL GEOGRAPHICAL SOCIETY.

[Published July 23rd, 1877.]

SESSION 1876-7.

Twelfth Meeting (Anniversary), *May* 28, 1877.

Sir RUTHERFORD ALCOCK, K.C.B., President, in the Chair.

The proceedings commenced by the Secretary (Mr. C. R. Markham) reading the Regulations which govern the Anniversary Meetings, and the Minutes of the Meeting of 1876.

The following new Members were elected:—*Rev. Sir Talbot Hastings Bendall, Bart.; Rev. George Brown; Walter Coates, Esq.; Frederick J. Dean, Esq.; Charles Edward Hamilton, Esq.; William Arthur Harrison, Esq.; J. Newby Hetherington, Esq.; William Grey E. Macartney, Esq.; Henry Turton Norton, Esq.; General John Meredith Read; Robert Stewart, Esq.; John Lloyd Wynne, Esq.*

Captain Toynbee and Professor Tennant were then appointed scrutineers of the Ballot.

The Report of the Council was next read by the Secretary, after which followed the

PRESENTATION OF THE ROYAL AND OTHER AWARDS.

ROYAL MEDALS.

The Founder's Medal was awarded to Captain Sir George S. Nares, R.N., K.C.B., for having commanded the Arctic Expedition of 1875–6, during which the ships and sledge-parties respectively reached a higher Northern latitude than had previously been attained, and a survey was accomplished of 300 miles of coast-line, facing a previously unknown Polar Sea; also for his Geographical services in command of the *Challenger* Expedition. The Victoria or Patron's Medal to the Pundit Nain Singh, for his great journeys and

Surveys in Tibet and along the Upper Brahmaputra, during which he has determined the position of Lhása, and added largely to our positive knowledge of the map of Asia.

Addressing first Captain Sir George Nares, the PRESIDENT spoke as follows:—

"Sir GEORGE NARES,

"In delivering to you the Founder's Medal of the Royal Geographical Society, the highest honour it is in their power to bestow, I am discharging one of the most agreeable duties of the President of this Society. I will only add that its primary object, which is to encourage Geographical Science and Discovery, does not exclude a just appreciation of the many high qualities displayed in your conduct of the Arctic Expedition, and without which the results attained could never have been secured. The discoveries which you, and the officers and men under your command, made of advanced Polar lands, were due to the energy, perseverance and endurance manifested by all, under hardships and difficulties of the gravest character. But especially do the records now before the world show the bold and skilful manner in which the ships of the Expedition were conducted, the leading vessel to the highest latitude yet attained, and probably possible of attainment by keel, and their safe return home from the hazards of ice-navigation of no ordinary character, even for Arctic Seas, with all appliances intact, and without accident to vessels or crews.

"With regard to the additions to our Geographical knowledge made by you, they cannot be better described than in the official language of the Lords Commissioners of the Admiralty when conveying their approval to you of the conduct of all engaged in the important service, which is as follows:—

"'Notwithstanding, however, that it was found impossible for the sledging parties to attain a much higher latitude than that reached by Sir Edward Parry, the addition to geographical knowledge has been considerable. The conjectural open sea to the north of Smith Sound, and the land assumed to be there, have been proved not to exist. The coast line of the northernmost land yet known, adjoining the American continent, has been accurately charted for 220 miles. The north coast of Greenland has been examined for 80 miles, and traced as far as Cape Britannia in lat. 82° 54′ N., long. 48° 38′ W. The western shores of Smith's Sound have been corrected in detail; and, lastly, the question of the possibility of reaching the Pole by way of Smith Sound has been set at rest, whilst a higher latitude than any hitherto attained, viz. 83° 20′ 26″, has been reached.'"

Sir George Nares replied:—

"Mr. President and Gentlemen:—It is with much pride that I receive this gift, and I accept it as a token that the work I have performed has obtained the approval of so distinguished and leading a body as the Royal Geographical Society. The bestowal of such a highly wished-for honour is of itself one of the highest rewards I could possibly ever have foreseen for my work, and it entails considerable responsibility for the future; for if, hitherto, I have done my utmost to advance our knowledge of the Globe we inhabit, so, hereafter, it will be my endeavour to bear worthily the very high distinction which has now been conferred upon me."

Colonel H. Yule, c.b., then came forward to receive the Medal on behalf of the Pundit Nain Singh. The President addressed him as follows:—

"Colonel Yule,

"Since Nain Singh's absence from this country precludes my having the pleasure of handing to him in person, this, the Victoria or Patron's Medal, which has been awarded to him for his great journeys and surveys in Tibet and along the Upper Brahmaputra, during which he determined the positions of Lhása, and added largely to our positive knowledge of the map of Asia, I beg to place it in your charge for transmission to the Pundit.

"I will myself address a letter to the Viceroy in India calling his attention to this award of one of the two Medals of the year, the highest honour this Society can confer on any Geographer, however distinguished by his services to Geographical Science or Discovery, and with a request that His Excellency will take such steps as he may deem best for its presentation to Nain Singh.

"But, in the mean time, I would beg you, who were the first to propose that this Medal should be so conferred, and took such generous and earnest interest in the recognition by the Society of Nain Singh's high claims to that distinction, to convey to him from me, as the President of the Royal Geographical Society, the satisfaction the Council have felt in thus publicly marking their high appreciation of the noble qualities of loyalty, courage and endurance, by the display of which in no ordinary degree he achieved success, and was enabled to add so largely to our knowledge of that portion of Asia which no European could explore. I would ask you also to add that the Council have not failed to see that he has not worked as a mere topographical automaton; and were perfectly aware that, notwithstanding he was a native of Asia and familiar with Tibetan dialects, his journeys were not accomplished without great peril to life. I would finally wish you to convey to Nain Singh, who in the performance of these distinguished services has suffered seriously in health by the extreme hardships attending his journeys, that I trust this public recognition of his merits as a Geographer from the Royal Geographical Society, which in its awards knows no distinction of nationality, race or creed, will be a source of satisfaction to him in his retirement, of which nothing can ever deprive him, to the end of a life he has devoted so faithfully to the public service and the advancement of Geographical knowledge."

Colonel YULE, in reply, said:—"I was taken by surprise when I was asked to officiate on this occasion as the recipient of the Medal for Nain Singh. The man who, beyond all others, ought to have occupied the position is Colonel Montgomerie, and I am sure that nothing but ill-health could have caused that gentleman to be absent on an occasion so interesting to him. Not only had Colonel Montgomerie given Nain Singh the most essential part of his training, but he was himself one of the most distinguished Himalayan explorers and surveyors, and had spent a considerable portion of his life at an altitude of 18,000 feet above the sea. I am utterly unknown to Nain Singh, and I shall therefore, by the leave of the Society, communicate the intimation of his having been assigned the Medal through Colonel Montgomerie. But though I do not know Nain Singh personally, I know his work, and can affirm that what the President has said about him is very just. He is not a topographical automaton, or merely one of a great multitude of native employés with an average qualification. His observations have added a larger amount of important knowledge to the map of Asia than those of any other living man, and his journals form an exceedingly interesting book of travels. It will afford me great pleasure to take steps for the transmission of the Medal through an official channel to the Pundit."

A Gold Watch, with an appropriate Inscription, was also presented to Captain A. H. Markham, R.N., for having commanded the Northern Division of sledges in the Arctic Expedition of 1875–6, and for having planted the Union Jack in 83° 20′ 26″ N., a higher latitude than had ever before been reached by any previous Expedition.

In delivering the Watch, the PRESIDENT said:—

"Captain MARKHAM, I have much pleasure in presenting to you, in the name of the Royal Geographical Society, this Watch, in public recognition of their appreciation of the valuable services you rendered in command of the Northern Division of Sledges in the Arctic Expedition of 1875–6, in the course of which you reached the latitude of 83° 20′ 26″ N., the highest that had been attained by any previous Expedition."

Captain MARKHAM replied:—

"Mr. President and Gentlemen:—I have to express my grateful thanks for the high honour conferred upon me. Though I have been selected as the recipient of the more substantial part of the honour, I know it will be felt and appreciated by my companions, without whom I should not have been placed in the position I now occupy. I cannot help thinking also, that apart from my having planted the Union Jack in the highest Northern latitude yet reached, I have been selected for this honour because I was the senior officer of the extended sledging parties of the Expedition. and that it is an acknowledgment on the part of the Royal Geographical Society of the geographical services which those parties rendered."

PUBLIC SCHOOLS' PRIZE MEDALS.*

The following was the award of the Examiners for the present year:—

PHYSICAL GEOGRAPHY. *Gold Medal.*—Walter New, Dulwich College. *Bronze Medal.*—Arthur Smyth Flower, Winchester College. *Honourably Mentioned.*—John Chisman, City of London School; J. A. Robinson, Liverpool College; Frank Stanton Carey, Bristol Grammar School.

POLITICAL GEOGRAPHY. *Gold Medal.*—William John Newton, Liverpool College. *Bronze Medal.*—John Wilkie, Liverpool College. *Honourably Mentioned.*—Arthur Reed Ropes, City of London School; William Wallis Ord, Dulwich College; Samuel Fowler Blackwell, Clifton College; George Arnold Tomkinson, Haileybury College; Henry Colthurst Godwin, Clifton College.

Mr. FRANCIS GALTON said it gave him much pleasure, on this as on many previous occasions, to be able to assure the Society of the public appreciation of the Examinations. Nearly all of the more important schools had at one time or another sent candidates. Eton had won no less than 5 out of the 36 Medals that had hitherto been adjudged, and 11 other schools had each contributed one or more names to the list of Medallists. There were at present only two important schools which had never sent a candidate, Harrow and Rugby. Many testimonies had been borne to the great service rendered to the cause of Education by these prizes. In a communication to the Conference of Head Masters held last Christmas, the Rev. George Butler, the Principal of Liverpool College, said he was grateful for the stimulus they afforded to the masters and boys, for the books that were suggested in the yearly programmes, and for the appointment of Examiners who had special knowledge of the country whose geography was the subject for the year. Invitations to compete were sent to 51 schools. Of these 17 responded, sending 22 competitors in Physical Geography, and 20 in Political Geography. The Medallists were reported by the Examiners to fully deserve their respective honours, and those who had received Honourable Mention, to be well entitled to that distinction. It had always been hoped that some of the very ablest youths at the schools would be induced to take an interest in Geography, and there was one remarkable proof that this had been accomplished, for Mr. McAlister, the Senior Wrangler of Cambridge this year, won the Gold Medal for Physical Geography in 1871. He (Mr. Galton) wrote to ask his candid opinion whether the time he had spent on Geography, in preparing to compete for the Medals, had on the whole been a help, a hindrance, or of no effect, in his academical career. His reply was full of gratitude for the benefits he received from that source, and his allegiance was still strong to the Society for the encouragement they had given him by their award.

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* The Medals offered by the Society for Geography, through the **OXFORD AND CAMBRIDGE LOCAL EXAMINATIONS**, were awarded for the year 1876, as follows:—**OXFORD** (June), ***Silver Medal***, John Wilkie, Liverpool College. ***Bronze Medal.***—Herbert Marlow Ward, Bridgnorth Grammar School (both for General Geography). **CAMBRIDGE** (December), ***Silver Medal*** (Physical Geography), ***Silver Medal*** (Political Geography), both to H. C. Temple, Brighton Grammar School.

Mr. F. Galton then introduced Mr. WALTER NEW, of Dulwich College, to receive the Gold Medal for Physical Geography, stating that he ranked decidedly first among the candidates. Last year he obtained the Bronze Medal, and this year the general style of his answers was such as would have done credit to a mature scholar.

The PRESIDENT, in presenting the Medal, said he was glad to find that the promise given by Mr. New in 1876 had been so richly and amply fulfilled.

Mr. F. GALTON said, before introducing the next in order of merit who was to receive the Bronze Medal, he wished to recall the memory and service formerly rendered to the Society by Admiral Smyth, who died twelve years ago, full of years and scientific honour, and to whom was due just one-half of the credit of the foundation of the Society, which was established by the combination of two contemporary and independent schemes, of one of which Admiral Smyth was the sole originator. It was he who revived the declining fortunes of the Society in 1849, when its numbers were diminishing, its expenses exceeding its income, and it was doubtful whether it would not entirely collapse. In that crisis, Admiral Smyth was elected President, and, under his sagacious and energetic guidance, new life was infused into the decaying Society; its influence made itself more widely felt, its numbers rapidly increased, and its resources were established on a firm footing. According to the reiterated expression of Sir Roderick Murchison, who was his immediate successor in the Chair, it was to Admiral Smyth that the first step was due that led to its present prosperous condition. The Bronze Medallist, Arthur Smyth Flower, of Winchester College, was the grandson of Admiral Smyth.

The PRESIDENT, in presenting the Medal, said it was peculiarly gratifying to him to do so; and he was quite certain that the manner in which the questions had been answered was merely an indication of what Mr. Smyth Flower would do thereafter.

Sir RAWSON W. RAWSON, as the Examiner in Political Geography, said he was very much disappointed that he had not the opportunity of introducing the two boys who had gained the Medals for Political Geography, more especially as the Bronze Medallist, John Wilkie, gained the Gold Medal last year for Physical Geography, and ran his competitor so close this year, that the papers had to be looked through twice, before it could be decided which was the best. He had heard that, if it had not been for the boy's attention having been devoted to other examinations, it was very likely that he would have won the Gold Medal. At the same time it enhanced the merit of the Gold Medallist, that he was a year younger than Wilkie. They were both from the same school, Liverpool College. Both the papers were excellent.

The PRESIDENT handed the Medals to Sir Rawson W. Rawson for transmission to the recipients.

The Hon. G. C. BRODRICK, in announcing the next year's subject as "The Nile Basin, and that part of Africa which lies to the East of it," said this might be called the classic region of Africa: for it was the oldest, as it certainly was the most recent, field of African geographical discovery. It possessed a special interest at present, because if the great scheme for the systematic exploration of Africa now in contemplation should be carried out, it was certain that one, if not more routes to be selected, would pass across that very region. So that in this case, as in the last two years, the candidates for the prizes would have the satisfaction of feeling that they were following in the footsteps of travellers who were actually engaged in making Geography. He was quite sure that by thus connecting geographical education with geographical exploration, the Society was rendering good service to both, and also promoting the interests of general education.

ALTERATION OF THE REGULATIONS.

Sir RAWSON W. RAWSON rose to propose the amended Rules, of which notice had been given, as having been agreed upon by the Joint Committee appointed by the Special General Meeting of March 5th. He said the Council felt there was a great difficulty to be dealt with, and that the problem of satisfying all the requirements of the Extraordinary Meetings was rather beyond them; they were, therefore, happy when the Joint Committee, appointed by the General Meeting, took the responsibility off their hands, and it was very satisfactory to be able to state that the Committee had been unanimous as to the recommendations to which they had agreed.

The Motion was that the Rules under Chapter V. of Section 3 of the Regulations be repealed, and the following enacted in their place:—

SECTION 3, CHAPTER V.

1.—The Ordinary Meetings shall be held on the Evenings of the Second and Fourth Monday of every month during the Session; or oftener, if judged expedient by the Council. The Chair shall be taken precisely at Half-past Eight o'clock.

2.—Fellows will be admitted to the Meetings, on showing their "Fellow's Ticket," which will be sent to all whose Subscriptions are not in arrear, at the commencement of each Session.

3.—Visitors, if introduced *personally* by Fellows, or by a Fellow's Ticket transferred for the occasion, may be present at the Meetings; such privilege of introduction being limited to *one* Visitor only for each Fellow.

4.—At the Ordinary Meetings, the Order of Proceeding shall be as follows:—

A. The Minutes of the last Meeting to be read, and, if their accuracy be not questioned by the Meeting, to be signed by the President or Chairman.

B. The Presents made to the Society since their last Meeting to be announced, and thanks ordered to be returned.

C. New Fellows to be introduced to the President or Chairman; result of Ballot of Candidates to be announced, and recommendations of other Candidates to be read.

D. Papers and Communications to be read and discussed.

5.—At the Ordinary Meetings of the Society nothing relating to its regulations or management shall be brought forward. But the Minute-Book of the Council shall be on the Table at each Meeting, and extracts therefrom may be read to the Meeting on the requisition of any Fellow.

6.—On occasions of exceptional interest, to be notified by the President at the preceding Meeting of the Society and duly advertised in the Daily Newspapers, ordinary Tickets will not be available; but applications from Fellows will be received at the Office of the Society for Orders of Admission for themselves and their friends, the number of Visitors to be restricted to one for each Fellow. Such applicants shall, in the order in which they apply, after the above notification, receive orders of admission for themselves and their friends to the seats set apart by the Council, for Fellows and their friends.

7.—On such occasions as described in Rule 6, Eighty Seats shall be reserved for Members of Council and their friends; and Fifty Reserved Seats for Visitors of distinction shall be at the disposal of the President.

Sir MORDAUNT WELLS said he had great pleasure in seconding the Motion to adopt the Report of the Committee. The Committee had come to a unanimous decision to abolish the blue ticket-books, which had been the chief cause of the evils which had been so much complained of, and the result would be, not to curtail the privileges of the Fellows in any way, for they would be allowed to introduce each a friend personally, and, if unable themselves to attend, to transfer their tickets to a member of their family, or any other person. He thought it most desirable, even with reference to the Ordinary Meetings, that this change should take place. Although the new Rules might not insure everything that might be desired, the Members might rest assured that the scenes which had taken place on previous occasions would never occur again. The Members of the Committee appointed by the Council were most anxious and willing to do everything they possibly could to meet the difficulties; and the fact that the Committee had come to a unanimous conclusion was to him, personally, a justification for the trouble he had given in endeavouring to bring about an alteration in the Rules. He felt that the action of the Committee had brought the great body of the Fellows into strict harmony with the Council, whom they so much respected.

Mr. ANDERSON wished to know whether the tickets issued to the Fellows for themselves and their friends on extraordinary occasions would be numbered in the order in which the applications were made, and would represent numbered seats in St. James's Hall?

Mr. JEFFS asked if the number of tickets issued would be limited to the number of seats?

The PRESIDENT, in reply, said what was contemplated by the Committee was that tickets should be issued representing the number of seats available, and those who applied for tickets after that number had been issued would be told that there was no more accommodation.

Mr. WILLIAM MORRIS JAMES said that as any arrangement which excluded Fellows from these Extraordinary Meetings was inadvisable, he would, without any desire to be in opposition to the

Council, propose the following amendment, "That the proposed new Rules should be referred back to the Council for consideration."

Dr. A. BUCHANAN seconded the amendment, and was supported by Dr. Glen, who thought that the existing Rules would work satisfactorily if they were really carried out.

Sir MORDAUNT WELLS said no one had been more anxious than himself to maintain the rights of the Fellows; but if the views expressed by the mover of the amendment were approved of, the result would be to exclude strangers altogether from these Meetings.

Lord HOUGHTON having appealed to the Members to give the proposed new Rules a fair trial, and an amendment proposed by Mr. ARTHUR to the effect "that those Members at Extraordinary Meetings, who might fail to obtain special tickets, should be admitted after the Chair had been taken, on production of their ordinary tickets," having fallen through for want of a seconder,

Mr. WILLIAM MORRIS JAMES' amendment was put, and negatived by a considerable majority of the Meeeting.

The PRESIDENT then put the original motion "That the new Rules be adopted," which was carried.

Lord COTTESLOE then moved that the words "or as near the date as may be found convenient" should be added to the present Rule I., Chap. V., Section 1.

The Motion was seconded by Sir HENRY RAWLINSON, and carried without opposition.

A vote of thanks was then moved by Mr. ANDERSON to Sir Mordaunt Wells, and the Committee that assisted him, for the Resolutions at which they arrived.

Professor TENNANT seconded the Motion, which was agreed to.

The Scrutineers then announced the result of the Ballot, the Council's list being declared duly elected.

The PRESIDENT then read the Annual Address on the Progress of Geography.

On its conclusion Mr. F. GALTON proposed a vote of thanks to the President for his excellent Address. The Fellows were greatly indebted to Sir Rutherford Alcock for the public spirit he had shown in conducting the affairs of the Society.

General STRACHEY seconded the Motion, which was agreed to.

On the motion of Professor TENNANT, a vote of thanks was accorded to the retiring Members of Council, and the Meeting then terminated.

ADDRESS

TO

THE ROYAL GEOGRAPHICAL SOCIETY.

Delivered at the Anniversary Meeting on the 28th May, 1877.

BY SIR RUTHERFORD ALCOCK, K.C.B., D.C.L., PRESIDENT.

GENTLEMEN,

THE period which has elapsed since the last Anniversary Meeting of the Royal Geographical Society has been an unusually eventful one in many respects. The return of the Arctic Expedition, quickly following that of the *Challenger*, and of Cameron from his marvellous journey across Central Africa, excited great interest in researches prosecuted in such widely-separated and diversified fields of Geographical discovery. The continued discussion of the various conditions of success, and the scientific results of Arctic exploration, as also the Meeting of the African Geographical Conference in Brussels last autumn, at the invitation of the King of the Belgians, are evidences of active interest which cannot fail to bear fruit at no distant period, and to promote the cultivation of Geography as a science in all its branches.

It has been the endeavour of the Council and myself, during the past year, to effect some of the objects glanced at in the last Anniversary Address of my predecessor, Sir Henry Rawlinson, as being then under consideration. I allude more particularly to the desire to extend in a more strictly scientific direction the range of the Geographical Society's work and influence. In pursuance of the plan sketched out in my opening Address, two out of three Lectures arranged for this Session, on Physical Geography in its higher and more scientific aspects, have been already delivered; the first by General Strachey, being an "Introductory Lecture on Scientific Geography;" and the second by Dr. Carpenter on "The Temperature of the Deep-sea Bottom, and the Conditions by which it is determined."

The names of both these gentlemen would be a sufficient guarantee of the excellence of their work, and its adaptation to the end in view. I may, however, be permitted to say that nothing could in my opinion have better realised the intentions of the Council, or better served the interests of Geographical Science, taken in its largest sense, than the admirable Lecture we listened to from General Strachey. The outline it supplied of the principal scientific aspects of Geography, in relation to its past history, and to the influences of Geographical conditions on the human race, left nothing to be desired. The principal matters that fall within the range of Scientific Geography were all succinctly traced in their natural order and connection; and with such clearness of exposition and arrangement, that the most recondite facts and principles lost much of their unattractiveness to the uninitiated.

So, in like manner, I may say that Dr. Carpenter's review of some of the more striking influences of the temperature of the Deep-sea Bottom, and the conditions by which it is determined, well illustrated the utility of not limiting our view of physical changes to the surface of the earth, or the more obvious forces in operation upon either the land or water. We were shown that, while exploring the bottom of the great ocean-beds, we were dealing with at least two-thirds of the surface of the solid crust of the globe. And in tracing the variations of temperature and its distribution at various depths over the whole oceanic sea-bed, we were in reality studying one of the most important of the physical conditions which affect the distribution of marine animal life and the direction and force of ocean currents.

We have yet the pleasure of anticipation in regard to the third Lecture, by Mr. Wallace, on "The Comparative Antiquity of Continents, as indicated by the Distribution of Living and Extinct Animals," which I hope we shall hear at the Ordinary Meeting of the 25th of June.

In a similar spirit of improvement and progress, the Council have at this moment under consideration the re-organisation of their Map Department, for which the resignation of their Curator, Capt. C. George, after a faithful service of twenty years, affords a favourable opportunity. They have in view to make it not only more complete and readily accessible, but to increase its utility by giving facilities for the use of their Diagrams, when required to illustrate

Lectures in the provinces, at a small fixed charge. It may involve some increased establishment and corresponding expense; but the Society is rich enough not to hesitate, if they can see their way to the useful application of their funds. Lending Diagrams, no doubt, exposes them to damage, and the Society to the cost of their renewal; but a comparatively trifling charge would probably cover this expense, while the service it will render to those who may not have occasion for the same Diagrams more than once or twice, would be great.

Turning from this aspect to our own progress, the Report of the Council affords sufficient proof of the increasing prosperity, and, I trust, of the usefulness of the Society. Our Members and income alike increase year by year; and so largely as regards the first, that it has become a subject of embarrassment on those rare occasions of extraordinary interest—such as the return of Cameron and the Arctic Expedition—when the great body of Fellows desire to attend the Meetings. Some not unnatural dissatisfaction was felt at the impossibility of many, on both these occasions, obtaining seats; and a Special Meeting was called to consider and report upon some Resolutions brought forward by Sir Mordaunt Wells, with a view to remove in the future the causes of complaint. Although some appearance of discord in our midst ushered in the discussion, the result was the appointment, with the full concurrence of the Council, of a Joint Committee of Inquiry; and its sittings, I am glad to say, were marked by the most perfect good feeling, and great unanimity as to the objects of the inquiry. The new Regulations, submitted for your approval at this Meeting, were carefully considered with the single object of providing for the convenience of the Fellows on all occasions—ordinary and extraordinary—and remedying as far as possible the evils hitherto complained of. Whether they will, in practice, effect this end, or be more successful than various others that have been already tried with a similar object, is a question on which the Council scarcely feel justified in pronouncing any very decided opinion; but they saw no objection to their adoption as a tentative course proposed by the Joint Committee appointed for that purpose at the Special General Meeting of March 5th. Some of the difficulties are, I fear, insuperable, and no rules that can be devised will wholly prevent inconvenience and disappointment, when the numbers to be accommodated are so large. One trifling change in the standing rule determining the day for the Anniversary Meeting has been proposed by the Council, merely to guard against being compelled to hold it on a day inconvenient to every one, such as Whit Monday or any other public holiday. Had any discretionary power been allowed, I should have deferred the Meeting on this occasion for another week, as the Whitsun holidays are still unexhausted.

Before terminating these preliminary remarks, I must express on your behalf, as well as on that of the Council and myself, our cordial thanks to the Senate of the University of London for the continuance of the privilege they so liberally accord us of holding our Meetings in this commodious Hall.

I will now proceed to the matters of more permanent interest, which form the proper subject of this Report. And my first duty, in accordance with past traditions and the usual order of proceeding, is to bring before you a record of the losses sustained since the last Anniversary by the death of many distinguished Geographers, and fellow-labourers in this field.

OBITUARY.

ADMIRAL SIR EDWARD BELCHER, K.C.B.—By the death of Sir Edward Belcher, on the 18th of March, in his 78th year, the Society has lost one of its oldest and most distinguished Fellows. He was one of the original members, of whom scarcely twenty now remain, who joined it on its formation in 1830.

Sir Edward Belcher was both a scientific and a practical cultivator of Geography, as well as an accomplished master in the kindred science of Hydrography. He was essentially a worker. A student of science from his boyhood, he has left his mark on many branches of it, and his works will long survive him. Many who have preceded him, and some who still remain, have owed, in great measure, to his example and instruction much of the eminence to which they may have attained in public life. It is, however, to his services as a geographer and explorer that we confine ourselves in this brief record.

He first brought himself into public notice when he sailed with Beechey as a Lieutenant and Surveyor on board the *Blossom*, in her voyage to the Pacific and Behring Straits. In this voyage, which extended over nearly four years, Lieutenant Belcher took a most active and important part.

In the comparatively imperfectly known condition of the Pacific at this period, the duties of a surveying ship were chiefly confined to fixing accurately the astronomical positions of the various groups of islands which were fallen in with, making such cursory examinations and surveys as time would admit of, and expunging from the charts many supposed dangers which the uncertainties of longitude had repeated in several positions, and which proved a source of anxiety and perplexity to the ordinary navigator.

In this way the *Blossom*, leaving the coast of America, visited the Easter, Ducie, and Pitcairn Islands, the latter celebrated in connection with the mutiny of the *Bounty*; she thence proceeded to the Gambier Group, which were surveyed in considerable detail; subsequently, to many of the low coral isles of Polynesia, when several new ones were discovered, and the positions of others correctly determined, and in March 1826, she reached Tahiti, the principal of the Society Group. After remaining a few weeks here, she sailed for Behring Straits, by the Sandwich Isles and Kamtchatka, a portion of her captain's instructions being that she should pass the summers of 1826–27 in this region in order to co-operate with Parry and Franklin, then exploring the Arctic Seas, in case either of them should succeed in accomplishing the North-West Passage. In July 1826, the ship reached Kotzebue Sound, when, with the assistance of her decked boat, a survey of the coast to the North was commenced, the ship herself reaching a point which was named Cape Franklin in 71° 7′ N. latitude, and her barge a position considerably further advanced. Foiled in their expectation of meeting Franklin's land party, although the boat had reached within 120 miles of his farthest western position, the *Blossom* quitted Behring Straits in the middle of October, and returned to resume her surveying duties in the Pacific, until the time should again have come round for a second attempt. During this second stage of the voyage, San Francisco, then under the Mexican flag, was visited and surveyed. From thence the ship proceeded again to the Sandwich Isles, searching unsuccessfully for various reported islands on the route, and arrived at Honolulu in January 1827. Early in March she bore away across the Pacific for China, rectifying the positions of such islands as lay near her course. Macao was reached in April. The Loo Choo Isles were subsequently visited, and some weeks were passed in making such observations and examinations as were possible in this little-known locality. Passing thence northward to Kamtchatka, Kotzebue Sound was again reached on the 5th of August, 1827. Here the decked boat was prepared for a second voyage of exploration to the North, and under Lieutenant Belcher's command examined the coast from Chamisso Island to a position beyond Icy Cape, a distance of between 300 and 400 miles. On his return to Kotzebue Sound, after experiencing many risks, his little vessel was driven on shore in a gale of wind, and totally wrecked on Chamisso Island, three of her crew being drowned. The *Blossom* now finally quitted Behring Straits, all hope of attaining the principal object of her mission, viz. the meeting with Franklin, being at an end. After revisiting California and other ports on the American coast, she rounded Cape Horn, and returned to England in October 1828.

Lieutenant Belcher having been promoted to the rank of Commander in 1829, was in 1830 appointed to the command of the *Ætna*, employed in surveying the West Coast of Africa and parts of the Mediterranean. One of the principal features of his African work was the close examination of the dangerous shoals which extend some 70 miles off the coast in the neighbourhood of Rio Grande, south of the Gambia. This he effected by carrying off a floating triangulation by means of his ship, the *Raven* tender, two decked barges, and large beacon buoys, all of which were moored in position, and thus formed fixed objects from which to correctly determine the position of the shoals, and to carry out the necessary soundings. The violent surf on this part of the African coast, together with the hostility of the native tribes, rendered surveying not a little harassing as well as hazardous. It was in this neighbourhood that Captain Skyring subsequently fell a victim to the treachery of the natives.

The *Ætna* was ordered to pass the winter of 1832 within the bar of the Douro River, for the protection of British interests during the struggles between the parties of Doms Pedro and Miguel. Here Captain Belcher lost no opportunity of distinguishing himself; on one occasion he opened a communication with the Miguelites, by which the merchants inside and the squadron outside were enabled to obtain fresh supplies. The *Ætna's* crew, moreover, habitually manned the Bar boat which kept up communication with the squadron, and while exposed to the danger of the surf in crossing the Bar in rough weather, not unfrequently became a target for both the contending parties. Being on the spot myself as one of the besieged, I can bear personal testimony to the excellent service rendered by Captain Belcher and his crew during this trying period.

On the raising of the siege of Oporto, the *Ætna* went up the Mediterranean, and among other services there thoroughly examined the Skerki Rocks, settling the question that there was one, and not two, as had been reported.

On the paying-off of the *Ætna* in 1833, Captain Belcher was employed for some time on the survey of the coasts of the United Kingdom, principally in the Irish Channel.

We next find him in command of a Surveying Expedition, composed of the *Sulphur* and *Starling*, in the Pacific. In this voyage, like that of the *Blossom*, it was not contemplated that any very extensive surveying operations of a consecutive character could be carried out; neither the coasts nor isles of the Pacific were yet ripe for such operations; the great land-marks of the picture, so to speak, had to be firmly established before the details could be filled in, and so the voyage in question was principally occupied in carrying chronometrical distances between distant points, and making such accurate surveys as time would permit over a more or less limited area in the neighbourhood of these principal stations. Thus at Panama, where Captain Belcher assumed the command of the Expedition in January 1837, a survey was made of its bay and neighbourhood, when the two vessels immediately proceeded to San Blas in Mexico, nearly 2000 miles distant, examining *en route* the ports of Realejo and Libertad; they then stretched across the Pacific to the Sandwich Isles, a further distance of nearly 3000 miles. In this run Clarion Island was visited, and a cluster of islands which had been reported between the meridians of 130° and 135° W., proved not to exist, the same which had been unsuccessfully searched for by the *Blossom*.

On the 23rd of July the ships sailed from the Sandwich Isles for the North, and reached Port Etches, in King William Sound, lat. 60° 30′ N., towards the end of August. The principal object of this cruise was to settle the discrepancies between the longitudes of Cook and Vancouver, and to determine the position and height of that great feature in the coast-range of North-West America, Mount St. Elias. The necessary surveys having been completed for the accomplishment of these objects, the Russian Settlement of Sitka was next visited; and, after calling at Nootka Sound, in Vancouver Island, to determine the longitude, the ships proceeded to San Francisco in California, which they reached on the 19th of October. During their stay there of about a month, the River Sacramento was surveyed for a distance of 150 miles from the ships' anchorage. Leaving San Francisco the end of November, and examining several portions of the coast and islands adjacent, San

Blas was again reached on the 20th of December, 1837. The next important stage on the voyage was Callao, where the *Sulphur* arrived in June 1838, having, in the mean time visited and surveyed Acapulco, the Gulf of Papagayo, Port Culebra, and Cocos Island.

After a refit at Callao, the Coast of Peru was surveyed for about 60 miles to the south, when the ships again proceeded north, and, after securing observations at Payta, and making some examinations in the Gulf of Guayaquil, they arrived at Panama in October, where the first stage of the voyage may be said to have ended.

By the end of March 1839, surveys were completed of the extensive Gulfs of Fonseca and Nicoya in Central America, as well as of Pueblo Nuevo and Baia Honda, after which the Sandwich Isles were again visited, and then the ships moved northerly, repeating, to a great extent, the cruise of 1837, verifying observations then obtained, and adding to the work by new surveys. By September, the Bar and entrance of the Columbia River had been surveyed, and a reconnoissance of the river made as high as Port Victoria, the chief trading port of the Hudson's Bay Company. After leaving the Columbia, the ships proceeded to San Francisco, and from thence examined the Coast of California, and surveyed its several ports as far south as Cape St. Lucas, the entrance of the great gulf. At San Blas, which was reached in December 1839, orders were received to return to England by the western route, thus completing the voyage by a circumnavigation of the globe.

Accordingly, on the 1st of January, 1840, the two vessels set sail once more across the Pacific. The islands of Socorro and Clarion were visited, and their positions determined. The Marquesas Islands were reached the same month, and then they passed on to Bow Island, a coral formation in the lagoon, where six weeks were spent in the operation of boring for the volcanic formation on which these islands were suspected to rest. Subsequently Tahiti, and other of the Society Islands, were visited, and in succession the Friendly Group, the Fijis, New Hebrides, New Ireland, and New Guinea; at all of which observations were made, and such surveys as time would admit of.

The ships then passed through Dampier Strait, called at Gilolo, Amboyna, Macassar, and reached Singapore in October of the same year. Here Captain Belcher found orders to proceed immediately to China, and for more than a year the *Sulphur* and *Starling* took an active part in the hostilities with that country, making such surveys as were essential to enable the fleets and the land forces to act with the best effect, and which tended materially to the capitulation of Canton, and the successful issue of the campaign.

The *Sulphur* finally arrived in England in July 1842, after a voyage extending over little short of seven years. For these services Commander Belcher received his post-rank, was nominated a Companion of the Bath, and shortly afterwards received the honour of Knighthood.

On the conclusion of peace with China, which followed shortly after the *Sulphur's* return, it was decided to commence a regular survey of the coasts, ports, and rivers, north of Canton; and the *Samarang*, a 26-gun frigate, was prepared for this service, Sir Edward Belcher being appointed to the command of her in November 1842. Political considerations, however, led to the *Samarang's* sphere of action being shifted to Borneo and the neighbouring islands of the Eastern Archipelago north to Japan—a sufficiently wide limit, embracing as it did some 40 degrees of latitude.

The vessel reached her station in the middle of 1843, and immediately commenced her work at the Sarawak on the west side of Borneo. Here she had the misfortune to ground on a reef, fall over, and sink in the river; but by the skill and energy of her captain was raised again, and, with the loss of less than a month's time, proceeded on her mission, viz. the examination of the Bashee Islands, the Majico-Sima group east of Formosa, Luzon, Mindoro, and Mindañao of the Philippines; the Sulu Isles, Celebes, and Ternate.

At the conclusion of this stage of the voyage, Sir Edward Belcher having been severely wounded in a boat-encounter with the piratical prahus of Gilolo, the ship returned to Singapore, and after a short rest there resumed her employment, revisiting some of her former stations, examining portions of Loochoo, the island of Quelpart, the Korean Archipelago, and Japan; she returned thence to the Mindoro and Sulu Seas, and concluded her labours by surveying the north-west coast of Borneo, from the island of Balambanjan, in the Strait of Balabac, to Labuan, then just become a British possession. The *Samarang* was now ordered home, and reached England on the last day of 1847.

Sir Edward Belcher's next employment afloat was in command of an expedition to the Arctic Seas in search of the missing ships under Sir John Franklin. This expedition, consisting of five vessels, left England in April 1852, and on arrival at Beechey Island, in Barrow

Strait, was separated into two divisions, the one proceeding westward to Melville Island, while Sir Edward himself, with two ships, ascended the Wellington Channel, and wintered at its head in an inlet which he named Northumberland Sound, in lat. 76° 52′ N. In the spring of 1853 he personally explored by sledges to the north, discovered and partially surveyed North Cornwall in 77° 30′ N., and the strait which bears his name leading eastward into Jones Sound; while other parties from his ships discovered and explored the north shores of Bathurst Island and Melville Island; and, crossing the latter, communicated with the division of the squadron under his second, Captain Kellett. A second winter was passed in Wellington Channel, and in the autumn of 1854, there seeming no probability of extricating the ships, four of them were abandoned, the crews returning over the ice to Beechey Island, whence they proceeded to England. With this voyage closed Sir Edward Belcher's active professional career; but he has continued to be a valued working member of this and other kindred Societies, and his active and gifted mind was devoted to the pursuit and cultivation of science and knowledge up to the latest days of his life.

Lord MILTON.—Amongst the Fellows of more than ordinary distinction, removed by death during the past year, I regret to have to include the name of Viscount Milton, who died in January last, at the early age of thirty-eight. Lord Milton had been a traveller from his youth up, and, in spite of a delicate frame and frequent illness, he succeeded in accomplishing substantial geographical work of considerable importance. His uncertain health compelled him to seek fresh life and vigour from time to time in some more bracing climate; and after several journeys to the Continent, and one to Iceland in 1861, he crossed the Atlantic to North America, and visited the regions to the west of the Red River Settlement in the Hudson Bay Territories. The favourable effect upon his health produced by the invigorating climate of the Great Plains, and the charm of the wild life there, induced Lord Milton to return there the following year, in company with Dr. Cheadle, with the view of making a more extensive exploration of the North-West Territory. At that time the gold mines of Cariboo, in British Columbia, were attracting much attention, and the only practicable route to them was the extremely circuitous one by Panama, or the little less indirect and more toilsome journey through United States territory by way of California. Although the rich mining districts of British Columbia lie almost in the direct line across the Continent through British territory, the way was barred by the great chain of the Rocky Mountains; and on each side of the main range lay a wide extent of rugged country, covered with dense forest, and in great part unexplored. Lord Milton and Dr. Cheadle determined to make the attempt to discover a way through this difficult and trackless region which separated the plains of the Saskatchewan from the mining districts of British Columbia, and they set out on this expedition in the spring of 1863. The story of this adventurous and toilsome journey, graphically related by Lord Milton and his companion in "The North-West Passage by Land," is probably familiar to most of us. Provided with very inadequate resources for such an arduous undertaking, the party endured great hardships and privations before they succeeded in forcing their way by the Yellow Head or Leather Pass, and through the dense forest of the North Thompson River, to the plains of Kamloops. Had Lord Milton enjoyed the full vigour of health, his enterprising spirit would have led him to further geographical research. But the renewed strength, which, in spite of its hardships, he eventually obtained from this journey, did not endure. After the lapse of a few years, he was compelled by increasing illness to resign the seat in Parliament to which he had been elected after his return, and he once more crossed the Atlantic to North America. The last few years of his life he spent chiefly in the highlands of Virginia; returning to England, however, shortly before his death at the commencement of the present year.

The practical value of Lord Milton's work has been well shown by subsequent events. His Expedition served, perhaps more than anything else, to direct public attention to the immense value of the southern portion of the Hudson Bay Territories, and to the great importance of establishing a way of communication between the eastern and western portions of British North America. This has been followed by the acquisition, by the Dominion of Canada, of the Hudson Bay Territories; and since that was effected, complete surveys have been carried out for a road and railway across the Rocky Mountains into British Columbia. These works have, indeed, been actually commenced; and the line chosen is identical with that followed by Lord Milton's Expedition. The route traversed by his party, with so much toil and difficulty, will before long complete the link of communication between the Provinces of the Canadian Confederation, and eventually become the great highway to the Pacific through British North America.

LOUIS ARTHUR LUCAS was the only surviving son of the late Mr. Philip Lucas, of Manchester, a gentleman well known for his liberal charities and philanthropy. Our deceased Associate was born on the 22nd of September, 1851, and at the time of his death was only twenty-five years of age. He was educated at University College School, in Gower Street, from which he passed to University College, where he showed a marked taste for scientific subjects. He studied Chemistry under Dr. Williamson, and was an apt and skilful experimentalist. At a very early age he expressed a desire for a life of adventure; but his parents having destined him for commercial pursuits, he was urged to fit himself for a business life at Manchester. His thirst for travel and scientific enterprise, however, prevailed; and was increased, rather than slaked, by a trip to Switzerland in 1870, during which he made an unusually rapid ascent of Mont Blanc. Before settling down to business, he visited the United States in 1872; and, after making the ordinary tour through Canada and part of the Eastern States, extended his tour to the "Far West," for the purpose of seeing the Indians and shooting buffaloes. By good fortune he met General McClellan on the Pacific Railway, who most kindly gave him letters of introduction to the Commandants of the Forts in the West, and these officers afforded him the opportunities he required. He shot buffalo and deer in Nebraska, puzzled the Indian Chiefs by his tricks of legerdemain, in which he was a most skilful amateur, and returned home at the end of 1872, after a most adventurous trip of four months' duration.

At the commencement of the following year he had the misfortune to lose his surviving parent (his mother), and soon after fell into a delicate state of health, for which change of air and scene were ordered. He selected Egypt as his health resort, and started at the end of 1873, with a doctor as his companion. He did not on this occasion show any marked spirit of enterprise; his state of health, and the domestic affliction from which he had suffered severely, precluded the desire for much adventure. However, he thoroughly enjoyed the Nile; and Eastern life, as so often is the case, cast its *glamour* over him, and on leaving Egypt he determined, whenever the opportunity offered, to return and see more of the country and of the people. His return to England was delayed by an attack of typhoid fever, supposed to have been caught at Naples, the subsequent effects of which lasted for many months, during which time he devoted himself to the study of science. He studied Botany with ardour, and made considerable progress in that subject. He also studied Comparative Anatomy, Zoology, and Geology, and during the whole winter and following spring led the life of an industrious student. Feeling now qualified for the great task he had set himself, in the month of July 1875, he announced to his family his intention to devote himself to African exploration, and that he had determined to seek out the source and the course of the River Congo. His family received this intimation with dismay, feeling assured he was unfitted by his youth and constitution for such an undertaking. They addressed themselves without delay to Sir Henry Rawlinson, our late President, begging him to use his influence to deter him from so hazardous an expedition; but Sir Henry's endeavours and the efforts of other influential friends were alike unavailing. Mr. Lucas was resolved to go, and organised his Expedition independently of our Society. Having become acquainted at the Geographical Congress of Paris in July 1875, with Dr. Nachtigal and Dr. Schweinfurth, he obtained valuable advice regarding his equipment and route from those travellers. He left London on the 2nd of September 1875, and made his way to Cairo, where he remained several weeks learning Arabic, engaging servants, and making preparations for his Expedition. He obtained a firman from the Khedive, after a personal interview, at which he was most graciously received, authorising him to enlist and train soldiers for escort; and from all quarters he received assistance for the great objects he had in view. He travelled by way of Suez, Suakim, and Berber to Khartum, where he arrived at the end of January 1876. He remained for nearly three months in Khartum, organising his Expedition, and making preparations for the absence of several years beyond the limits of civilisation. Delays also occurred in communicating with Colonel Gordon, with whose consent only could a traveller ascend the Nile into the Central Provinces. All difficulties having been overcome, in April Mr. Lucas left Khartum, and, with the assistance of the steam-vessel lent by Colonel Gordon, ascended the White River as far as Lardo, where he met Colonel Gordon. It very soon became apparent that Mr. Lucas's Expedition could not succeed. Colonel Gordon showed him that his escort was too weak and too untrustworthy for him to venture to the southward, either through Albert Nyanza or through

Rumanyika's country, between the Lakes Victoria and Albert to Nyangwé, which place he wanted to make the true starting-point for his discoveries. Colonel Gordon pointed out to him that if he persevered in his Expedition, with such an insufficient escort, he would be either massacred by hostile natives, or deserted or shot by his own men; and that he (Colonel Gordon) would not permit him to go on to certain destruction. Mr. Lucas most reluctantly yielded to these arguments, and later submitted himself unreservedly to Colonel Gordon's advice. Colonel Gordon's advice was, if still bent on African exploration (against which he strongly dissuaded him as being unfitted by health and constitution), to return to Khartum; and thence go by way of Suez to Zanzibar, there to organise his Expedition, and make a fresh start under better auspices, and in a less deadly climate, to those sources where he hoped to gather fame and honour. Mr. Lucas nevertheless accompanied Colonel Gordon to the Albert Nyanza, and navigated the northern portion of the Lake in the first steamboat ever launched on its waters. In August 1876, Mr. Lucas turned his steps northwards, intending to carry out his original scheme of the exploration of the Congo in the manner suggested by Colonel Gordon. His health had already suffered considerably from fever, and when he reached Khartum, on the 4th of September, he was unable to walk. Indeed, for several weeks previously he had been carried on an angareb by his porters. During the months of September and October, attack followed attack of fever and dysentery, and, utterly prostrated by these illnesses, he at last was compelled to give up his cherished scheme of African exploration, and determined to return to England. This resolution came too late. On the 26th of October, though dreadfully weak, he was sufficiently improved in strength to be moved from Khartum. He left in a dahabiah especially provided by the kindness of the Khedive, and reached Berber on the 2nd of November. He then, eager to reach home, began the desert journey to Suakim, without waiting to recruit his strength; he crossed the desert in six days, and on the 18th of November he arrived at Suakim. Whether exhausted by the fatigue of the journey, or as a result of the disease, at Suakim he had an accession of illness. He was in an exhausted condition put on board the S.S. *Massowah*, bound *viâ* Jeddah for Suez, and within twelve hours, viz. on the 20th of November, he died suddenly, at the early age of twenty-five. His remains were landed at Jeddah, and interred in the cemetery there with much honour and respect. His aims were noble, his character inflexible and most persevering; his scientific qualifications were considerable; he possessed great warmth of heart and most genial manners, which endeared him to all who knew him, but he lacked the physical qualities necessary to constitute an African explorer.

Captain JOHN EDWARD DAVIS, R.N.—The sudden death of this active and zealous officer has caused the greatest grief amongst his connections and friends, many of whom, like himself, were well known in geographical circles.

He entered the service in 1828 or 29, and served in various ships on the Pacific and West India Stations. In 1835 he joined H.M.S. *Beagle*, under the late Admiral Fitzroy, which may be said to be the commencement of his thirty-six years' service in the scientific branch of the Royal Navy. Whilst in that ship he assisted in the survey of the coasts of Chili and Peru.

In 1839 he was appointed second master of H.M.S. *Terror*, on the Southern Expedition commanded by the late Sir James C. Ross, and made three voyages to the Antarctic regions, fulfilling the duties of surveyor and draughtsman to the Expedition. On his return in 1844 he was promoted, and appointed to the survey of the West Coast of Ireland, under Captain G. A. Bedford (now Vice-Admiral) where he served with great credit for nearly ten years, joined afterwards the survey of the South Coast of England and that of the Orkneys.

In the spring of 1860 he was detached from home service to accompany the *Fox* in her Expedition to discover tidings of Sir John Franklin's ships, returning to Portland Roads in November of the same year. Since that date he had been employed as Naval Assistant in the Hydrographic Office of the Admiralty. During his service there he conducted a series of experiments on thermometers for deep-sea purposes, which led to those used so successfully in H.M.S. *Challenger* in her recent voyage of discovery, and he devised also improvements for sounding in great depths.

He was the inventor of an improved astronomical sextant, by which, through the adaptation of a micrometer movement, a series of observations can be made without the necessity of reading-off at the time of observing, and other advantages, which met with the approval of the Astronomer Royal. He also completed and published Azimuth Tables that had been commenced by the late Staff-Commander Burdwood.

Captain Davis had only retired from active service about two months, having served in the Navy for nearly half a century. Latterly he had been giving lectures in various parts of England on Arctic Explorations, and at the time of his sudden death was engaged to deliver one at Bristol, for which he had just completed drawings and diagrams.

WILLIAM BOLLAERT, our late genial Associate, was born in 1807, and at an early age entered into scientific pursuits. He was for some time Chemical Assistant to Sir Humphry Davy, Mr. Brande and Mr. Faraday, at the Royal Institution, and made some original discoveries in benzoic acid. But, owing to his father's affliction of blindness, and consequent inability to attend to his profession of medicine, Mr. Bollaert was unable to continue his connection with the Laboratory of the Royal Institution, and accepted an offer to go to Peru as assayer and chemist in the survey of silver mines. His subsequent accounts of the silver mines of Guantajaya and other famous mines of the Province of Tarapaca, which have been published, contain much useful information.

Whilst in Peru, Mr. Bollaert devoted a great deal of his attention to the geography, geology and natural history of the country, and wrote many interesting papers on these subjects, which have been read and published by various Societies. In 1827 he made, at the request of the Intendente Castilla (afterwards President of Peru), a survey of the Province of Tarapaca, and his "Observations on the Geography of Southern Peru, including Survey of the Province of Tarapaca and route to Chile by the coast of the Desert of Atacama" were read before our Society in 1851. He also published much useful information regarding the nitrate of soda, and the formation of the new boracic acid mineral, in Peru. Mr. Bollaert was one of the first "white" men who crossed the Desert of Atacama, exploring the country, and searching for the meteoric iron of Atacama.

Returning to England, Mr. Bollaert endeavoured to make arrangements, under the patronage of our Society and of the Government, to explore the East Coast of Africa from Zanzibar, to visit Lake Nyassa, and to ascertain the probabilities of an Expedition crossing the African Continent. He was, however, unable to get his proposals carried out.

In 1832-33 he accompanied the late Sir John Milley Doyle to Portugal, and served as a volunteer. During this time he gathered the materials for his publication on the 'Wars of Succession of Portugal and Spain from 1826-1840, containing an account of the

Siege of Oporto in 1832, and Political and Military Reminiscences.' For his services he received the War Medal, and was created a Knight of the Order of the Tower and Sword of Portugal. He was subsequently engaged in assisting the late Baron de Haber in financial matters relating to Dom Carlos and Dom Miguel, and received from the hand of Dom Miguel the decoration of the Order of Fidelity.

On the abdication of Dom Miguel and Dom Carlos, Mr. Bollaert went to Texas to explore the country as to its fitness for European emigration, and at the request of H.B.M. Consul at Galveston, he examined the interior and coasts, and made Reports thereon, which were sent to the Admiralty. He supplied some interesting papers on the Indian tribes of Texas, and on the botany and natural history of the country, for various Societies and publications. But owing to his health being impaired by yellow and intermittent fevers, he returned to England.

In 1853 Mr. Bollaert received the Bronze Medal of the Society of Arts from the hands of the President, the late Prince Albert, for his "Essay on Salt, with Observations on the Origin of Salt and Saline Bodies," and giving further details of the inexhaustible quantities of nitrate of soda existing in Peru, and information concerning a new boracic acid mineral. He afterwards returned to Peru, and made some valuable antiquarian and ethnological researches in New Granada, Ecuador, Peru, and Chile, accounts of which, with his 'Observations on the Pre-Incarial, Incarial and other Monuments of Peruvian nations,' were published by Messrs. Trübner & Co. Several interesting papers on the gold ornaments, pottery, &c., discovered by him in the ancient tombs of Peru, were published by the Society of Antiquaries in London, and he presented to the British Museum several specimens, amongst others a unique vase representing the head of a Chinese Ruler.

Mr. Bollaert was requested to examine the coal mines of Chile, and his Reports on the same were read in the University of Santiago in Chile, and before the Royal Geographical Society in London. For this, and for his researches in Peru, the University of Santiago elected him a corresponding Member. After remaining for some time in South America, visiting the whole of the West Coast, crossing the Andes and visiting the Argentine Republic, Paraguay, and the Brazils, he returned to England.

A severe illness and rupture of the lungs quite incapacitated him for any further active life; but up to the close of his career he took the greatest interest in the Societies of which he was a Member, and from time to time published accounts of his researches for the Royal Geographical Society, the Ethnological Society, the Society of Antiquaries, the Medico-Botanical Society, the Anthropological Society, the Society of Literature, and for various publications.

He died on the 15th of November last, in his sixty-ninth year.

Professor K. E. VON BAER.—This eminent savant, equally celebrated as a Naturalist and Geographer, died on the 28th of November last, at Dorpat. He was elected Corresponding Member of our Society as far back as 1843, about which time he acquired a high reputation as a scientific traveller, by his journey to Lapland and Nova Zembla, which he undertook under the auspices of the Imperial Academy of Sciences of St. Petersburg. His family came originally from Hanover; but at the time of his birth, in 1792, were settled in Esthonia, and it was not until 1834 that Von Baer took up his permanent residence in St. Petersburg. He had received a medical education, first at Dorpat, and afterwards at Vienna and Würzburg; but his tastes inclined him, as he grew to manhood, to the study of Zoology, and in 1822 he was appointed Professor of that science at Königsberg, where he founded the now existing Zoological Museum. His eminently active mind preserved him from a life of contracted studies in a special branch of science, and he was always to the fore as an organiser or administrator in all that concerned the subjects which he had studied. In the Imperial Academy of St. Petersburg, he first served as Councillor and Librarian; but his activity was afterwards displayed in a variety of public ways,—in Educational questions, University organisation, sanitary matters, and so forth. His Expedition to Lapland and Nova Zembla took place in 1837, and he was the first to make and bring home a collection of plants from the latter region, where he spent six weeks in assiduous research. In the years 1851 to 1856 he was employed by the Government in investigating the fisheries in the Volga and Caspian, the result of which mission was the important geographical work in four volumes, with Atlas, published by him at St. Petersburg in 1857–9. On his retirement from the Academy in 1861, he was elected an Honorary Member. Although this is not the place to enter into details regarding his work as a Biologist, his great and special services to science as a philosophical thinker and worker in the great subject of evolution, must be mentioned. In connection with this may be cited his important work, 'Ueber Entwickelungsgeschichte der Thiere.' Among his geographical works may be enumerated his Paper on the effect of the earth's rotation on the erosion of river-banks—an ingenious treatise, in which the tendency of rivers gradually to swerve from a direct course, since known as "Baer's Law," was attempted to be proved and explained—and his well-known 'Kaspische Studien.' Conjointly with Count von Helmersen, he also edited the long series of volumes of original Papers on Russian Geography, entitled 'Beiträge zur Kenntniss des Russischen Reiches und der angränzenden Länder Asiens,' a serial publication of great value to geographical students, which extended over the years from 1839 to 1873.

The **Marquis de Compiègne.**—This enterprising traveller, whose premature death at Cairo on the 28th of February last, at the age of thirty years, excited much public attention at the time, was a Fellow of our Society, having been elected in 1873. He commenced his career as a traveller by a tour, chiefly inspired by the love of adventure and the chase, in the Southern States of America, particularly in Florida, of which he published an amusing account in the 'Tour du Monde.' In 1873, actuated by the desire of Geographical discovery, he undertook, with his colleague, M. Marche, a more serious journey to the Gaboon, and organised there an Expedition up the river Ogowé, which, according to the report of traders and natives, had its origin in a lake in the far interior of Equatorial Africa. The means for this important journey were obtained, M. de Compiègne subsequently stated, by the sale of objects of Natural History obtained by himself and his companion. Arrived at the Gaboon, they commenced their boat-journey up the Ogowé on the 9th of January 1874, and by the end of March of the same year had reached the country of the cannibal Osyeba, a tribe which had not previously been visited by Europeans. Here at the confluence of the Ivindo their party was attacked by this hostile and implacable tribe, and after the loss of many men in the struggle which ensued, they were forced to retreat. The observations made during this adventurous voyage were published by M. de. Compiègne on his return to Paris, under the title of 'L'Afrique équatoriale;—Gabonais, Pahouins, Gallois; and Okanda, Bangouens, Osyeba," 1875. About the same time, an Expedition on a larger scale, under the leadership of M. de Brazza, was organised in Paris, for the continuation of the line of discovery opened up by this enthusiastic young traveller; but the much impaired state of his health did not permit him to take part in it, and he accepted the offer made to him by Dr. Schweinfurth of the post of Secretary to the Société Khediviale de Géographie, recently established in Cairo, of which Dr. Schweinfurth was then President. The duties of this position he had filled for about a year, when he died, in consequence of a wound received in a duel, on the 28th of February last.

MONSIGNOR FRANCESCO NARDI.—In the month of March last died at Rome one of our Honorary Corresponding Members, Monsignor Francesco Nardi, for some particulars of whose biography I am indebted to his old and intimate friend, His Excellency the Commendatore Cristoforo Negri, also one of our Honorary Corresponding Members, and the distinguished Founder of the Geographical Society of Italy. Francesco Nardi was born of a noble family at Vazzola, near Conegliano, in the province of Treviso, in 1808. He entered the ecclesiastical profession, and soon distinguished himself in his studies by versatility of genius and a most retentive memory. During the Austrian dominion in Venetia and Lombardy, many Italian youths went to study at Vienna, Monsignor Nardi among them, and he was in the superior Institute of Theology, founded by Joseph II., for the teaching of principles alike uniform and noble in the education of the clergy. Cristoforo Negri was at the same time studying law in the same University. A few years afterwards both were nominated to Professorships in the University of Padua,—Nardi of Common Law, and Negri of Political Science. They had already both of them studied Geography at Vienna, and continued their studies at Padua, and both in turn lectured there on Statistics. The Revolution of 1848 separated them. Negri emigrated to Turin, Nardi remained at Padua, whence he removed to Rome as Auditor of the Rota Romana for Austria. There Monsignor Nardi read to the Accademia Pontificia de' nuovi Lincei several geographical papers on the African and Polar Expeditions, and on the Cruise of the *Challenger*. Politics, however, had already diverted him from peaceful and quiet studies. He was one of the most indefatigable, earnest, and even violent defenders of the cause of the Pope; Director of the 'Voce della Verità' newspaper, and a frequent traveller to every part of Europe on missions imposed upon him or undertaken voluntarily. This precluded him from that eminence in geographical studies to which he might have aspired from his genius, his culture, his linguistic attainments, and his widespread relations with men of learning in every part of Europe and elsewhere. For many years Nardi had been a member of numerous scientific bodies, and seemed likely soon to attain the Cardinalato, a position he much coveted, having been nominated "Secretary of the Congregazione dei Vescovi," an office which usually opens the road to that dignity.

It may be said of Nardi that no difference in political opinions, even the most diametrically opposite, ever interfered with his affection and esteem for those whom he had once reckoned among his old friends.

CHARLES ENDERBY, F.R.S.—The late Mr. Charles Enderby was the son of Mr. Samuel Enderby, whose name was familiar to all geographers some thirty years ago as the enterprising merchant whose vessels, engaged in the whale fishery of the Southern Seas, made so many important discoveries in the Antarctic Ocean. Among these discoveries was that of the Auckland Islands, south of New Zealand, made by Captain Abram Bristow in 1806, whilst in command of one of the vessels belonging to the Messrs. Enderby; and some years after, Enderby Land, further to the east. Our late Associate, on succeeding to the business with his brothers, maintained the reputation of his house for its enlightened care of scientific interests; and it was under his direction that Captain Biscoe discovered Graham Land, and other portions of the Antarctic continent, previous to the voyage of Sir James Ross. The Auckland Islands were ceded to Messrs. Enderby by Her Majesty's Government as a whaling station, and in 1849 a whaling establishment was formed there under their auspices. Previous to this, Mr. Charles Enderby published a pamphlet on the group, under the title of 'The Auckland Islands, their Climate, Soil, and Productions,' a work which comprises nearly all that was known at the time regarding this region. Mr. Enderby served on our Council in the years 1842–4, and again in 1845 and 1847. He died on the 31st of August last. He was one of the original Members of the Society, having entered in the year 1830.

The Right Hon. Sir DAVID DUNDAS.—This distinguished lawyer, who died on the 31st of March last, at his residence in the Temple, always took a deep interest in geographical studies. He was for many years a Member of the Council of the Hakluyt Society, and was latterly its President. The eldest surviving son of the late Mr. James Dundas, of Ochtertyre, in Perthshire, he was born in 1799, and educated at Westminster School and Christ Church, Oxford, where he took his degree at the age of twenty-one. He was called to the Bar in 1823, and made Queen's Counsel in 1840. In the latter year he was elected Member of Parliament for Sutherlandshire, and represented that county continuously for twelve years, until 1852; in 1861 being again re-elected, until 1876. He was Solicitor-General from 1846 to 1848, and Judge-Advocate-General from 1849 to 1852. He was elected a Fellow of our Society in 1841, and served on the Council in the years 1853 and 1854.

Captain CHARLES STUART FORBES, R.N.—The death of this adventurous officer and genial companion, at the comparatively early age of forty-seven, was felt as a serious loss by the numerous circle of friends who so highly valued him. He was a Member of our Society since 1860, and in 1866 contributed an interesting paper on a journey he had made the previous year round the shores of Volcano Bay in the island of Yesso—a paper which excited an important discussion on the occasion of its being read,* and was afterwards published in the 'Journal,' vol. xxxvi. Captain Forbes commenced his professional career as a Midshipman under Sir Everard Home, on the Australian Station. He commanded a gunboat in the Baltic during the Crimean War, and afterwards served in the China War as Lieutenant commanding the *Algerine*. After the conclusion of peace with China, he had scarcely reached home when the remarkable campaign of Garibaldi in Sicily and Naples excited his adventurous and generous spirit, and he threw himself with ardour into the daring operations of the revolutionary chief. He participated in the first action outside Palermo, and was the first to enter Naples, and bring to his chief the intelligence that the Royal troops had evacuated the city. These details, though not geographical, are necessary to repeat, in order to give an idea of the character and career of the man. Returning to England, he published an excellent account of the Garibaldian campaign, in a volume which had a considerable success. He subsequently visited Iceland, and published an account of his journey; after which he re-entered active service as Commander of the *Curlew* on the River Plate, returning from this cruise just in time to accept the command, under the late Captain Sherard Osborn, of one of the vessels of the Expedition equipped for the service of the Emperor of China. During the Civil War in America he commanded a blockade runner, and performed wonderful feats of skill and daring in this hazardous school of seamanship. The war over, he entered the service of the ill-fated Maximilian in Mexico; and returning to England after the perils and sufferings of this period, he set off, in 1865, on a private venture of his own to Cochin China and Japan. Subsequently he was engaged in mercantile adventure in California and Nevada, and, returning to England, died at his residence in the Albany, on the 12th of May, 1876.

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* 'Proceedings of the Royal Geographical Society,' vol. x. p. 170.

Sir J. W. KAYE, F.R.S.—This eminent official in the Indian Department of our Government was born in 1814, the second son of Mr. Charles Kaye, formerly Solicitor to the Bank of England. He was educated at Eton, whence he proceeded to the Royal Military College at Addiscombe, where he passed through the studies necessary to qualify him for military service in India. He served subsequently for some years as officer in the Bengal Artillery; but his ardent love of literary pursuits led him to resign his commission in 1841, and for some years he devoted himself to literature. In 1856 he entered the Home Civil Service of the East India Company, and when the government of India was transferred to the Crown, he was appointed to the Secretaryship of the Political Department of the India Office, succeeding in this post to Mr. John Stuart Mill. The responsible functions of this office he filled with much credit, until failing health compelled him to retire in 1874. He was created Knight Commander of the Star of India in 1871, and elected a Fellow of the Royal Society in 1866. To the general public he was better known for numerous important historical and biographical works relating to India which flowed from his pen, the most important of which were—'The History of the War in Afghanistan,' 'The History of the Administration of the East India Company,' 'The Life and Correspondence of Lord Metcalfe,' 'A History of the Indian Mutiny,' 'The Life and Correspondence of Sir John Malcolm,' &c. He was elected a Fellow of our Society in 1865, and died on the 26th of July last.

Professor WILLIAM HUGHES.—We have to regret the loss, since our last Obituary was written, of this most industrious and learned

Geographer, who died on the 21st of May, 1876. He was for many years Professor of Geography at King's College, and recently filled also the post of Professor of the same branch of learning at Queen's College. To the general public he was better known as the author of numerous Manuals on the subject which he had made the study of his life, and to the compilation and continued improvement of which, in successive editions, he devoted all the best years of his hard-working, well-spent life. The amount of research and painstaking required in the preparation of such a work as his 'Manual of British Geography,' must have been truly prodigious. Manuals compiled with so much industry and conscientiousness could not fail of being appreciated by the public; they therefore gradually made their way into some of our best public schools, and new editions were repeatedly called for, upon the last of which he was working at the time of his death. The following are the titles of some of his chief works:—'Maunder's Treasury of Geography;' 'Principles of Mathematical Geography' (1843); 'Manual of British Geography' (1851); 'Manual of European Geography' (1851); 'Manual of Geography, Physical, Industrial, and Political' (1860); 'The Geography of British History' (1863); 'Treatise on the Construction of Maps' (1864); 'Geography in Relation to History' (1870), &c.

The following Members have been also lost to us by death during the year, many of whom were distinguished in various walks of life, although not known as Geographers: Colonel H. R. Addison, Sir A. Bannerman, G. T. Brooking, Rev. J. Brereton, Francis Buckley, Edwin Brown, T. B. Baker, Edw. Beldam, Dr. L. Cape, H. Cope, C. H. Chambers, H. Collinson, J. Crowdy, Sir Edw. Cunynghame, Bart., J. Dickinson, H. J. Dunell, F. S. Dutton, J. Edward, H. Field, Col. W. F. Grant, I. Gerstenberg, Capt. J. T. Greenfield, Lieut.-Col. F. A. Gould, W. E. Heeley, E. J. Hutchins, A. B. Halloran, T. Hamilton, P. D. Hadow, A. Hector, T. A. Kjaer, G. Kenrick, Dr. R. P. Linton, Dr. A. E. Mackay, T. W. L. Mackean, T. Malby, G. Mathews, Rev. J. Ouvry-North, Capt. Oldfield, W. Phelps, E. C. Ravenshaw, J. Reeve, J. Reynolds, J. V. Shaw, Admiral Swinburne, Sir J. Stuart, Lord Sandhurst, Lord Sudeley, Major P. Swan, Lieut.-Col. G. Thompson, H. Thurburn, C. Verrey, T. Wilson, W. C. Wentworth, and H. Waite.

Admiralty Surveys.*—The year since the last Presidential Address has been marked by the return to England and the close of two Expeditions, which have rendered important services for the advancement of Geographical and Hydrographical science. The results of the deep-sea exploring voyage of H.M.S. *Challenger*, and the Expedition for discovery and research in the Arctic regions in H.M.'s ships *Alert* and *Discovery*, have given fresh impulse, and rendered large additions, to several branches of scientific inquiry. Further, the professional skill displayed by the leaders and crews of these Expeditions, in conducting their ships under many hazardous conditions, and with perfect security, will form bright pages in the annals of our naval history.

Admiralty Surveys, both at home and in our Colonies, are with undiminished force making steady progress. Additions to the surveying ships-of-war on foreign service have been made by the appropriation of the steam-corvette *Fawn* and the sailing-schooner *Alacrity*; the former for employment at the outset in the Red Sea and on the Zanzibar Coast, the *Alacrity* for the hydrographic development of the Fiji group and its countless coral reefs.

Notwithstanding these additions to the surveying force of the Hydrographic Department, it is found difficult to keep pace with the demands made in the interests of commerce for marine surveys, both in extension of imperfectly-known coasts, and for greater details to those already accurately charted.

Shores of the United Kingdom.—Staff-Captain Parsons, in H.M.S. *Porcupine*, has been engaged on the shoal-grounds between Yarmouth Roads and Dover; this included a re-examination of the Hewett and Cockle channels. From the continuous movements of the sands in these localities, frequent surveys are required in the interests of shipping. The shoals at the entrance of the River Thames have also undergone examination in extension of Captain Calver's former survey of 1862–3. Shoreham Harbour has also been re-surveyed.

In continuation from the preceding year, the survey of the Solway Firth, from the sea to the end of the navigation at Bowness railway bridge, has been completed by Staff-Commander J. H. Kerr, assisted by Navigating-Lieutenant Langdon. Marked changes in the channels and shoals over the whole area have taken place since the Admiralty Survey of 1837. This officer has also completed a survey of St. Tudwall Bay, a neighbourhood now rendered more available for shelter by the recent admirable marking of its dangers and approaches by lights and buoys, under the direction of the Trinity Corporation.

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* By Captain F. J. O. Evans, C.B., F.R.S., Hydrographer of the Admiralty.

On the east coast of Scotland, the bar of the River Tay has been surveyed in minute detail by Staff-Commander George Stanley, a necessity arising from changes which have taken place since the surveys of 1833 and 1866.

In Ireland, Staff-Commander Hall, with an assistant, has been engaged in surveying the upper part of the River Shannon from Wellesley bridge, Limerick, to Cains Island. Since the Admiralty Survey of 1841, changes have taken place in the bed of this river. The increased draught of ships visiting Limerick since the opening of the floating-dock has further rendered a re-survey on a large scale necessary.

Mediterranean and Red Sea.—Commander Wharton, late of the *Shearwater*, in his newly-commissioned ship the *Fawn*, with a strong staff of young surveying officers, and assisted by Staff-Commander Millard, resumed in the past autumn the examination in detail of the seaboard from the Damietta mouth of the River Nile to Port Said, and also re-sounded that part of its approaches in continuation of the survey of March 1875. In comparing the present condition of the Damietta mouth with that as charted in 1856, it is found that the sand-bars are considerably pushed forward, but retaining more or less of the former shape of the river's mouth; and that there is also a slight advance of the land. The mast of a vessel, wrecked and sunk on the bar about seven years since, is now considerably inside the western point of the river, showing an unusually rapid advance of the coast. Captain Wharton, however, observes that the sand-bars are daily shifting, and that it is probable an unusually heavy winter gale may from time to time wash away the accumulations of many years. Another interesting fact is given by Captain Wharton. At the time of the *Fawn's* visit it was the period of highest Nile. The water issuing from the Damietta mouth is then so charged with matter that it forms a species of breakwater to the shore to leeward, the wind being comparatively powerless to raise it into waves, and the swell coming from the northward being nearly entirely killed by it. When there was a heavy swell of a height of 6 feet from trough to summit outside the line of Nile water, inside this dirty water, and on the bar, no swell of any kind was visible. Locally, this is known as the Mishta season; and advantage is then taken to anchor trading-vessels close to the bar, in no more water than they draw.

With reference to Port Said, the soundings were found more uniform than in any of the previous surveys. This was accounted for by the season of the year. Previous surveys had been made in the spring, before the inequalities scoured out by the winter gales had time to settle. The shore-line at the western breakwater had advanced 105 feet since March 1875, an interval of nineteen months. The shore to the east of the canal-entrance, and near the eastern breakwater, is washing away.

Passing into the Red Sea, Captain Wharton defined some of the outlying dangers in the neighbourhood of the Suakim Islands and the opposite Arabian Coast; made a complete survey of the port of Jiddah, and then commenced the survey of the Massowah channel. This inshore route on the African coast, between the parallels of 15° and 17° N., is likely to be of considerable value. Under-powered and small steam-vessels experience difficulty, and of course detention, in making headway against the strong southerly winds which blow in the central part of the Red Sea south of the 17th N. parallel during the winter months. In the Massowah channel moderate winds and smooth water are experienced; the various islands and headlands on the passage serving as constantly recurring land-marks, and there is anchorage nearly everywhere.

Mauritius.—Although a skilful triangulation had been executed so far back as 1753 by the well-known Abbé de la Caille, and accurate maps of the island exist, the hydrographic features of this valuable colony have hitherto been very imperfectly rendered. It was accordingly arranged, in the interests of modern navigation, that a general plan of the shores should be executed on the scale of one inch to the nautical mile—the soundings being carried out to the 100-fathoms' contour-line—and that plans of the harbours should be made on suitable scales.

Navigating-Lieutenant Coghlan was selected for the duty; and this active and intelligent officer, with very limited appliances, has in the first year completed the survey of the shores of the northern and more important half of the island, with its approaches, together with Port Louis; and has examined also, to some extent, the Grand Port. Lieutenant Coghlan contemplates completing the service afloat by the close of the present year.

Indian Archipelago and China.—The *Nassau*, Commander Napier, with his efficient staff, has broken ground on the seaboard of China, at Haitan Strait and its neighbourhood. The chief mission of this party is to examine in detail the several dangers lying close to the shore, discovered since the excellent preliminary surveys of Kellett and Collinson of the Royal Navy (1840–6), by the hugging of the land during the strength of the north-east monsoon of the numerous large steam-ships engaged in trade between the Treaty Ports.

Prior to taking up this work at the favourable season of the year, Commander Napier made an excellent survey of the Dinding Islands in Malacca Strait, and the intricate channels and anchorages between the larger islands and the mainland; connecting at the same time the mouths of the Perak river with this survey; further taking a line of soundings for telegraph purposes between Penang and Rangoon.

The *Nassau* performed, *en route* to Hong Kong, good service in Carimata Strait by accurately determining the position of several prominent islets and dangers on the southern limits of this highway to the China Sea; adding to the soundings, and charting one more unknown rock in the fair-way of navigation with as little as 9 feet of water over it.

South-West Coast of Korea and Japan.—Captain St. John and his effective staff, in H.M.S. *Sylvia*, have been engaged for some time making an examination of, and connecting trigonometrically, the many groups of islands extending far seaward from the south-west coast of Korea, and lying in the line of direct sea-communication between Japan and the northern ports of China.

Detailed surveys of Murray Sound and the Mackau group in this region were made, and in the latter a good anchorage for moderate-sized vessels was found. This haven (named by Captain St. John after himself) will in time doubtless prove useful to storm-bound mariners. Here, as on the mainland, according to the former experience of the officers of the *Sylvia*, the islanders (Korean) displayed unconcealed dislike to the presence of strangers, and it required both tact and forbearance to avoid open rupture in carrying out the useful service of charting the group.

The northern part of the Goto Islands—westward of Nagasaki—as also the Kuga channel through the central part of the group, have been surveyed in detail by the *Sylvia's* officers.

Newfoundland and Labrador.—The labours of Staff-Commander Maxwell and his party, in the hired steam-vessel *Gulnare*, are still divided between Placentia bay in Newfoundland and the N.E. Labrador coast. The latter can alone be examined in the middle of the summer season. Coast details in continuation of former work has occupied the time, especially the development of Frenchman's Run, a channel of much value to the fishing fleet.

The early and later parts of the season have been spent in charting the West coast of Placentia bay, and the examination of several off-lying shoals, these proving a source of embarrassment to the telegraphic cable arrangements, from their hitherto uncertain position.

Jamaica.—Lieutenant Pullen, with his small party, in a sailing schooner, has completed in continuation a creditable survey of the south coast of the island included between Milk river and Luana point, with the extensive off-lying bank of soundings, and also executed an enlarged plan of the Black River anchorages. This energetic young officer is pushing his survey rapidly to the east end of the island.

Western Australia.—Staff-Commander Archdeacon and his party are steadily working along the inhospitable shores of this colony, triangulating and charting in detail its rugged and broken features. From Swan River southward round Cape Leeuwin, and thence to West Cape Howe, near King George Sound, the coast-line has been completed; the anchorages at Koombanah bay and in Géographe bay sounded over; together with the positions of the dangerous reefs northward of Cape Naturaliste, and the innumerable outlying dangers off the much-dreaded locality of Cape Leeuwin, accurately charted.

The surveying officers report that from Cape Naturaliste to Cape Leeuwin there are only a few scattered settlers; between the last-named cape and West Cape Howe the country near the coast is quite uninhabited, being almost a continuous forest, rendering the carrying out of the survey not only most laborious, but entailing hardships and privations of an unusual character. Staff-Commander Archdeacon and his party deserve much credit for the energy and endurance with which they have overcome so many physical obstacles, and given us at the same time accurate surveys.

South Australia.—Staff-Commander Howard, with two naval assistants, in the hired schooner *Beatrice*, has now completed in continuation the coast from Cape Catastrophe to the northern shores of Streaky bay, with the off-lying soundings.

The broken sea-board of this important colony has therefore (with the exception of about 450 miles in the neighbourhood of the great Australian Bight), now been charted in detail by Admiralty Surveyors.

Victoria.—The detailed survey of Banks Strait has been completed by Staff-Commander H. J. Stanley, cordially assisted by the Victorian Government. In addition, large-scale surveys of Waterhouse anchorage and the Bay of Fires on the Tasmanian coast have been executed.

Queensland.—The surveying party under Staff-Commander Bedwell have during the past year surveyed in comprehensive detail the FitzRoy river from its seaward approaches to the town of Rockhampton: the shoaler portions of the Mary river below Maryborough, over which dredging operations are contemplated; and also the small Noosa river in Laguna bay, north of Brisbane, in lat. 26° 24′ s.

Fiji Islands.—Lieutenant W. U. Moore, in H.M.'s schooner *Alacrity*, has taken up the work among these Islands in succession to Lieutenant Dawson. His early duties were to survey Savu Savu bay in Vanua Levu, as also Nandi bay; both of these localities having been named as favourable sites for the proposed new capital of the Colony. It is now understood that Suva bay, surveyed by Lieutenant Dawson, offers superior advantages, and that the seat of Government will be removed thither from Levuka.

Lieutenant Moore has also completed the examination of Kandavu Island, and its encircling and outlying reefs extending to North rock on Astrolabe reef.

Deep-Sea Exploring Expedition.—In the Address of last year it was announced that the *Challenger's* labours were drawing to a close, and that her arrival in England might be daily expected. The proceedings were then brought up to the re-entry of the ship into the South Atlantic Ocean in January 1876, and the sailing from Monte Video towards the end of February, to complete sectional oceanic observations across to Tristan da Cunha.

In order to preserve a continuous record of the proceedings to those already rendered for the years 1873–4–5-6, the following sketch will bring these to their termination on the arrival of the ship at Spithead, and the paying-off of the *Challenger* and dispersion of her officers and crew in June of last year.

Between Monte Video and Tristan da Cunha twelve soundings with serial temperatures were obtained; making, with similar observations in the track of October 1873, fifteen determinations in this interesting region. In the western half of this traverse—on about the 37th parallel of south latitude—the greatest depth was 2900 fathoms, and a bottom temperature obtained (31° to 31°·5 Fahr.) colder than had been found in any part of the several oceans, except in the immediate neighbourhood of the Antarctic regions. The stratum of water below the temperature of 32°, further had an average height from the bottom of 2400 feet. In the eastern part of the traverse the depths were shallower, 1715 fathoms being the least found, the bottom temperature in this portion rising from 32°·8 to 34°·7.

From Tristan da Cunha deep soundings and temperatures were obtained onward to Ascension, and thence to the Equator; there forming a junction with the position in 3° N., of August 1873, and the deep-sea results of that time. Between the above oceanic islands the depths varied from 2020 fathoms to the comparatively shallower water, 1240 fathoms, and the bottom temperature was in no case so low as 35°. Approaching the Equator from Ascension, the depths increased to 2350 fathoms, and the bottom temperature became colder, it having been recorded as low as 32°·7.

A summary of the work done in the Atlantic Ocean tells us that serial temperatures were obtained at 125 positions, 82 of which were north and 43 south of the Equator. With these incomparable results, aided by the deep-sea sounding labours of the German ship-of-war *Gazelle*, combined with those of earlier American and English navigators—as also the work of the *Valorous* on her homeward voyage from attendance on the Arctic ships to Davis Strait—Staff-Commander Tizard, the Navigating and Chief Surveying officer of the *Challenger*, has constructed a diagram showing on a Mercator's chart the deep basins of the Atlantic Ocean, together with nine sectional diagrams of isothermal lines from the surface downwards, severally arranged in meridional, longitudinal, and diagonal directions; these, with a valuable monograph on Atlantic Ocean temperatures, form the 7th number of a series of Reports on the *Challenger's* proceedings, printed by the Admiralty during the voyage for limited distribution to learned Societies and others interested.

Before closing these brief records of the *Challenger's* labours, it may be of interest to place a few statistical details before the Society. The voyage round the world occupied 3 years and 172 days. The distance traversed was 68,890 miles: the highest southern latitude reached—a region of icebergs and pack-ice—was 66° 40′ S.; and although many intricate seas were traversed, and lands approached which were scarcely known to the navigator, to the professional credit of all concerned the ship not once touched the ground.

To return to the great object of the *Challenger's* voyage: this, as is well known, was to investigate the physical and biological conditions of the great ocean basins. At intervals as nearly uniform as circumstances permitted, throughout the 68,890 miles traversed, 362 observing stations for these purposes were established. At most of these stations, in addition to the determination of the depths and temperatures, a sample of the bottom-water was procured for physical and chemical examination; a fair sample of the bottom-fauna was procured by means of the dredge or tow-net; and the fauna of the surface and of intermediate depths was examined by the use of the tow-net. Special care was taken for the preservation of these records. The collection of invertebrate animals is of great extent; and from most of the species being, it is understood, undescribed—and from the great peculiarity of the distribution of the fauna of the deep sea—this branch of inquiry, it is expected, will yield most interesting results.

The necessary investigations, and the preparation of a scientific account of the voyage, have been confided by Her Majesty's Government to Professor Sir Wyville Thomson, Chief of the Civilian Scientific Staff of the Expedition. This account, as estimated by Sir Wyville, will probably consist of a series of volumes, of which two will be devoted to a general description of the voyage, with such hydrographical details as may be necessary for the clear comprehension of the scientific observations, and to a full discussion of the general results, physical and biological; one volume to contain an account of the physical and chemical observations, with a special discussion thereon; and a further series of volumes (probably not less than six in number) containing a detailed account of the fauna, with plates illustrating the undescribed or imperfectly known forms.

Miscellaneous.—In addition to much useful Hydrographic information received during the year from officers of the Navy in different parts of the world, several commanding officers of the Mercantile Marine have contributed to our knowledge of the shores of China and Japan. Messrs. T. E Cocker, of the Chinese gunboat *Ling Feng;* J. C. Pendered, of the Japanese Government steamer *Thabor;* E. M. Edmonds, of the Peninsular and Oriental Company's steamer *Malacca;* and G. C. Anderson, of the steam-ship *Conquest,* deserve for their contributions special mention; their labours have been, or are, in course of publication. Sir Allen Young, and the officers of the Arctic yacht *Pandora,* extended our knowledge of the shores and anchorages at the entrance to Smith Sound.

Among other additions to Hydrography in the past year has been the discovery in the Atlantic Ocean of a comparatively shallow bank of soundings surrounded by ocean depths, 130 miles to the westward of Cape St. Vincent, in Spain. This was effected in the United States ship *Gettysburg*, Commander Gorringe, while engaged in carrying a line of deep-sea soundings, for telegraphic purposes, between Gibraltar and the Azores. Stormy weather and the advanced season prevented Commander Gorringe from making a full examination of the shoal area. The least depth obtained by this officer was 30 fathoms; but he was impressed with the belief that shoaler water would be found, and possibly that spots might exist dangerous to navigation. With this uncertainty pending, and the bank lying in the direct track between Lisbon and Madeira, the Admiralty caused an extended examination in March of this year to be made by H.M.S. *Salamis*, Commander F. W. Egerton, the despatch vessel attached to the Channel Squadron. This officer closely sounded the shoal-area by boats, finding not less than 30 fathoms; the *Salamis*, at anchor during the time of springs, found the tides setting regularly to the north-east and south-west at the rate of 1½ mile per hour; abundance of fish were caught. The shape and area of the bank included in depths less than 100 fathoms is nearly circular, with a diameter of about 5 miles, and is situated between the parallels of 36° 29½′ N. and 36° 34½′ N.

The shoalest part, within the depths of 35 to 30 fathoms, appears to be a narrow ridge 2 miles in extent, running nearly east and west: the least depth of 30 fathoms being confined to a small patch in lat. 36° 31½′ N., and long. 11° 35½′ W.

The nature of the bottom at depths less than 50 fathoms was found to consist of rock and coralline matter; in depths exceeding 50 fathoms, pebbles, coralline substances, shells, and sand.

Beyond the depth of 100 fathoms the soundings increase rapidly. The depth of 1000 fathoms from the shoal-ground being about 5 miles in a northerly direction; 6 miles in a southerly; 13 miles to the westward; and 11 miles to the eastward. At 20 miles distant in a north-westerly direction, 2750 fathoms were found; and in a north-easterly direction 1640 fathoms.

Summary.—The Notices to Mariners on subjects of immediate interest, such as the institution of new lights or alterations in old-established ones—similarly also with buoys and beacons—and especially the discoveries of new rocks or dangers, engage earnest attention: 167 of these notices, and 350 octavo pages of new hydrographic information of a less urgent nature, were issued during the past year.

Five volumes of sailing directions—including the second volume of the 'Mediterranean Pilot;' a second edition of 'Directions for the Dardanelles, Sea of Marmara, and the Bosphorus;' second edition of 'West Coast of Scotland,' Part II.; and 7th edition of Vol. I. of the 'Australia Directory,' have also been published.

In the chart branch, 62 new charts have been published, and 1896 charts have undergone correction; 180,000 copies have been printed for the general public and for the use of the Royal Navy.

ARCTIC REGIONS—*The Expedition of* 1875-6.—The chief event in connection with our Society since the last Anniversary Meeting has undoubtedly been the return of the Arctic Expedition, under Captain Sir George Nares. The largest Meeting of the Session was that which assembled to welcome the Commander and officers of the *Alert* and *Discovery*; and we have this day sealed our approval of the geographical work accomplished by the Expedition, by conferring on its leader the highest honour we have it in our power to bestow. Having borne testimony in this emphatic manner to the value of the results achieved, it will be proper in this place to review briefly the connection of our Society with this great Expedition, and to show from the expectations our Council always entertained and expressed, that the objects have been in a great measure attained.

The Council have always thought that the objects of Arctic exploration, in these days, must be to secure useful scientific results in Geography, by exploring the coast-lines, and ascertaining the conditions of land and sea within the unknown area left unexplored by all previous Expeditions. We have also dwelt specially upon the importance of encouraging a spirit of maritime enterprise, and of giving worthy employment to the navy in time of peace—a truly national object, and one which, as the result proved, had as much influence in forming the decision of statesmen as the scientific results. It was with these views that Sherard Osborn, on the 23rd of January, 1865, read his first Paper at a Meeting of the Society, on the exploration of the North Polar Region. His proposal was that two steamers should be despatched to Smith Sound: that one should winter near Cape Isabella; that the other should press up the western shore as far as possible; and that in the following spring, sledge operations should be directed over the unknown area. And again, in his Paper read April 22nd, 1872, he advocated the same route and a similar plan.

In consequence of this latter Paper, a Committee was appointed by the Council of the Geographical Society to consider the best means of bringing the subject before the Government: consisting of Sir George Back, Admiral Collinson, Admiral Ommanney, Admiral Richards, Sir Leopold McClintock, Captain Sherard Osborn, Dr. Rae, Mr. Findlay, and Mr. Markham. The Report of this Committee was unanimously adopted by the Council of the Society, on the 29th of April, 1872; and in the spring of 1873—the Royal Society having accepted our invitation to co-operate in these preliminaries—a joint Committee of the Royal and our own Society was appointed to prepare a Memorandum on the scientific results to be derived from the proposed Expedition. This Committee was composed of the same members as sat on the Arctic Committee of 1872, for the Geographical Society; and of Dr. Hooker, Mr. Busk, Mr. Prestwich, Dr. Carpenter, Dr. Allman, Mr. Evans, General Strachey, and Mr. Fergusson, for the Royal Society. In this Memorandum, dated June 1873, which was widely distributed, the scientific results were fully discussed in a series of paragraphs furnished by Dr. Hooker, Professor Allman, Mr. Prestwich, General Strachey, and Professor Newton; while the arguments derived from former experience and general policy were by Sherard Osborn.

On the 1st of August, 1874, Sir Henry Rawlinson and Admiral Sherard Osborn, accompanied by Dr. Hooker, had a very satisfactory interview with Mr. Disraeli, and on the 17th of November the Prime Minister addressed his well-known letter to Sir Henry Rawlinson, announcing that Her Majesty's Government had determined to lose no time in organising a suitable Expedition.

It is important that the objects of the Geographical Society in pressing this undertaking upon the Government should be kept in mind. The Council, in all its memoranda, abstained from setting forth the attainment of the highest possible northern latitude, and an attempt to reach the North Pole, as the main object of an Arctic Expedition. The object held steadily in view was the exploration of the largest area possible of the unknown region from a fixed base of operations, in order to secure useful scientific results. The course advocated was to navigate along a coast-line, to include the passing of at least one Arctic winter in the scheme, and to look to sledge-travelling as the main instrument of discovery and exploration. Consequently the Smith Sound route was, for the attainment of the above objects in accordance with these rules, the best that could be selected.

The Arctic Expedition returned in October 1876, after having succeeded in crossing the threshold of the unknown region by the Smith Sound route, established a base of operations beyond it, and explored the unknown area from the base to the utmost extent possible with the means at their disposal. As far as popular objects were concerned, the *Alert* had reached the highest north latitude ever attained by any ship; she had wintered farther north than any ship had previously wintered, and Captain Markham had reached 83° 20′ 26″ N., a point nearer the North Pole than any human being had ever been before.

As regards geographical discovery and research, the results of the Arctic Expedition are recorded in the exhaustive Report of Sir George Nares, presented to Parliament, and in the two Papers he has read at Meetings of the Society, on December 12th, 1876, and March 26th, 1877. The Parliamentary Report, together with the copious details, illustrated by charts and sketches, relating to the sledge journeys, leaves nothing to be desired on the part of the geographer—nor, indeed, of the general reader—as descriptive of discoveries made of advanced Polar lands, of the energy, perseverance, and endurance displayed by officers and men on the several explorations, frequently under difficulties and hardships of the gravest character. And especially do these records show the bold and skilful manner in which the ships of the Expedition were conducted—the leading vessel to the highest latitude yet attained, and probably possible of attainment, by keel—and their safe return home from the hazards of ice navigation of no ordinary character, even for Arctic seas, with all appliances intact, and without accident to vessels or crews. It was found that the coast lines beyond Robeson Channel trended away to west and north-east, forming the shores of a frozen Polar Sea, and from the base of operations formed by the *Alert* in 82° 27′ N. the members of the Expedition examined the coasts for a distance of 300 miles. Along the whole of this distance the ice of the Polar Sea was of the same character. Its existence was an unexpected and important discovery. This ice was found to be from 80 to 100 feet in thickness; formed by continual additions from above (due to the annual snow-falls), which, by the increasing superincumbent weight, is gradually converted into snow-ice. Complete sections of the huge masses forced upon the shore were carefully taken, and they show the way in which the whole is formed, as well as its great age. These masses had been broken off from the large floes of ice, and were grounded in from 4 to 10 fathoms along the whole coast. The process of formation of the ancient floes resembles that of glaciers, and the masses thus grounded had been chipped off from them. They in no way resemble the mere piles of broken-up hummocks that are often found on other Arctic shores. They are, in fact, icebergs broken off from fragments of floating glaciers, and have therefore received the appropriate name of FLOE-BERGS.

The *Alert*, in September 1875, had thus reached an impenetrable sea of ancient ice, intervening between those lonely shores and the North Pole. It is not, however, one vast congealed mass never in motion, which would have been the case if it had been formed in a stagnant and confined sea. On the contrary, it is subjected to annual disruption, and to violent commotion during the summer months. Early in July the whole mass is in motion, driving backwards and forwards with the winds and currents, its main course being towards the east. The floes grind against each other and are broken in fragments, while, whenever the angular corners of any of the fields meet, there pools of water are formed. In September the frost sets in, and these pools and narrow lanes are frozen over with ice that becomes about 6 feet thick during the winter, but motion still continues, and ridges of hummocks are thrown up between the floes. The stillness of the Polar winter does not prevail until late in October or November. Then a new formation of ice commences, and goes on for seven months, which far more than counterbalances the decay during the summer.

Such is the nature of the great Polar Sea beyond the channels leading from Smith Sound, which was discovered by the Arctic Expedition of 1875–76. It is so totally different from the Polar pack met with north of Spitzbergen, that, with a view to that precision without which Physical Geography cannot make progress as a science, it was necessary that some distinctive term should be applied to it. This portion of the Polar Ocean was therefore named the PALÆOCRYSTIC SEA, or sea of ancient ice: a name which has now been adopted by geographers, both in England and on the Continent.

Careful and diligent observation furnished some *data* by which a judgment might be formed of the probable extent of the Palæocrystic Sea. It is certain that land was not near to the north, because hills were ascended to a height of 1500 feet and upwards on clear days, and there was not a sign of land. But there are other considerations all tending to the same conclusion. There are no flights of birds to the north, which certainly would be the case if there was land; and the only living thing that was seen on the Palæocrystic Sea, by the northern division of sledges, was a little snow-bunting that had strayed from the nearest shore. Further evidence is furnished by the fact that animal marine life almost ceases to exist in the ice-covered Polar Sea. The Palæocrystic Sea is a sea of solitude.

The great extent of this Polar Ocean is assumed on the above grounds. There is also evidence that it is a comparatively shallow sea. The northern division of sledges, at a distance of forty miles from the land, found bottom in only 72 fathoms; and between that point and the shore several huge floe-bergs were observed, apparently rising out of the centres of floes, which were probably aground. Another indication of the present shallowness of the Polar Sea is the general recent upheaval of the adjacent land. Drift wood was found far above any point to which it could have been carried by ice or water.

As regards the distribution of land and sea within the unknown area, and its general hydrography, the discoveries of the Expedition are important. And it usually happens that when a new geographical fact is revealed, through the labours of scientific explorers, it is found that it harmonizes with other isolated pieces of knowledge which previously stood alone, as it were, and were not intelligible without it; the geographical and hydrographical results of the Expedition are also most important, because they have a practical bearing on the general system of oceanic currents and of meteorology, and consequently form an essential part of a vast whole. Without a knowledge of the hydrography of the Polar Region, all the general theories of oceanic currents must be incomplete; and Arctic research is, therefore, necessary to a science which is of practical utility. But the Expedition brought home other results, which are certainly not less interesting than those discoveries which immediately concern the Geographical Society. Among these may be mentioned the examination into the geological formation of the whole coast line on the west side of the Smith Sound channels from Cape Isabella to Cape Union, as well as of the shores of the Palæocrystic Sea on either side of Robeson Channel. Collections of rocks and fossils were made at every point, including a very complete Upper Silurian series, and the mountain limestone shells and corals of Cape Joseph Henry. But by far the most important geological discovery was that relating to the existence of tertiary coal in 82° N., and the former extension of miocene vegetation to that parallel. The Expedition also made an exhaustive collection of the biology of a region previously almost entirely unknown to science: the region north of the 82nd parallel, as distinguished from the Arctic countries to the southward. The whole *flora* of the new region has been brought home; and it must be remembered that meagre though this *flora* certainly is, Dr. Hooker has shown that it possesses special interest in connection with the remarkable distribution of American and Scandinavian plants. The zoology of the newly-discovered region has also been exhaustively examined, and very complete collections made as regards mammalia, birds, fishes, insects, molluscs, crustacea, echinoderms, and a vast number of microscopic forms. In physics a complete series of meteorological, magnetic, tidal and other observations, covering a year, has been taken at two stations.

As regards the conduct and management of the Expedition which secured these valuable results, the most essential object, and the crucial test of its success, is the attainment of a position as a base of operations beyond any hitherto discovered. To have brought a ship through the difficult channels leading north from Smith Sound, and to have found winter quarters on the open and exposed coast of the Palæocrystic Sea, protected only by grounded floe-bergs which might at any time be driven higher up or swept away, was in itself a great success. No other Arctic navigator ever forced his ships through such obstacles, and brought them safely back again; and this establishment of a base of operations within the unknown region called forth all the highest qualities of a commander—incessant watchfulness, great presence of mind, rapid yet cautious decision, and consummate seamanship.

Next to the establishment of a base of operations beyond any point previously reached, the most important preparation for exploration and discovery by sledges is the management of the Expedition during the long darkness of an Arctic winter, and the maintenance of the health and spirits of the men. The difficulties, in this respect, of the Expedition of 1875-76 were greater than any that had previously been encountered, because the winter was the longest and the most severe, and the continuous darkness was the most prolonged that had ever been endured in the Arctic Regions. Moreover, the absence of the warming apparatus supplied to former Expeditions increased the difficulty of preserving health. When these special disadvantages are considered, the efforts of the commanding officers of the late Expedition to preserve the health and keep up the spirits of the men are deserving of high praise. When the sun returned, the scheme for exploration by sledges was matured; and early in April 1876, under difficulties, and exposed to an extremity of cold beyond anything that had been experienced in former expeditions, the sledging parties left the ships.

Owing to the Admiralty Instructions, it was incumbent upon Captain Nares to push his principal party due north over the Palæocrystic Sea, with the object of attaining the highest possible northern latitude. As there was no land, it was not possible to lay out depôts, and all supplies, together with boats, had to be dragged on the sledges. The Admiralty had impressed upon Captain Nares (para. 15 of 'Instructions') that, in the absence of continuous land, sledge travelling for any considerable distance has never been found practicable. Yet, in order to attain the main object of the Admiralty, the attempt had to be made. The farthest north hitherto reached was on July 23rd, 1827, when Parry got to 82° 45′ N. But this was during the summer, and the work was done without the endurance of serious hardships, although the weights to be dragged per man were very great, namely 268 lbs. Captain Markham won the palm from Parry after he had held it for nearly forty-nine years. On May 12th, 1876, he reached 83° 20′ 26″ N., in the face of hardships and difficulties without a parallel in the annals of Arctic sledge-travelling. For this great exploit our Council have awarded him, as you have already learnt, a special honorary testimonial.

Three other extended sledge parties were organized to secure the true objects of the Expedition, from the point of view of our Society, namely, the extension of geographical knowledge. One was to explore the unknown region to the westward of the base of operations to the farthest point attainable; the second was to press eastward along the northern coast of Greenland; and the third was to examine the deep inlet named after Lady Franklin, which was believed to be a strait. All did their work admirably, and extended their explorations to the utmost limit, in two sad cases beyond the utmost limit, of human endurance. They fully, completely, and with heroic self-devotion, fulfilled the objects which our Arctic Committee had prescribed, by exploring that portion of the unknown region accessible by the Smith Sound route to the farthest extent possible with the means at their disposal.

Expeditions to the Obi and Yenisei.—With regard to other parts of the Arctic regions, it is interesting to record the considerable additions that have been made during the past season to our knowledge of the estuaries of the Obi and Yenisei, and the neighbouring parts of the Kara Sea, by German and Swedish expeditions. The latter, under the leadership of the celebrated Arctic Explorer, Dr. Nordenskiöld, succeeded, as in the previous summer, in reaching the estuary of the Yenisei. The German party, consisting of Messrs. Finsch, Brehm and Zeil, equipped by the German North Polar Exploration Society, devoted itself to the examination of the isthmus separating the Bay of Kara from the River Obi. It had been previously stated by Captain Wiggins, who has devoted himself with great zeal and intrepidity to the exploration of a trade-route by sea to the Obi, that a practicable road might be found, by means of tributary streams, across this neck of land, thus materially facilitating the approach to the Russian trading centres in North-Western Siberia. The exploration last summer by the German *savans* abovenamed has, however, set this matter at rest for the present. Decending the Obi to Obdorsk, they made a gallant attempt to traverse the neck of land separating that part of the river from Kara Bay: the small rivers were navigated, with much difficulty, to their headwaters, and sledges were then employed in traversing the desert Tundra; but they were unable to reach the shores of the bay, and were obliged to return. The canalisation of the isthmus they consider impracticable.

RUSSIAN EXPLORATIONS.—The attempts to unite Western Siberia with Europe by the navigation of the Glacial Ocean form one of the chief geographical undertakings in Russia during the past year. But although the achievements of the Russian explorers, as well as those of Nordenskiöld and Wiggins, will enrich science by many valuable discoveries and interesting communications, it is doubtful whether they will, at all events for some time to come, be productive of real advantage to the country itself. And this may be said with equal truth of the recent relations between Western Siberia and China, undertaken with the view of establishing commercial intercourse with the inner provinces of the Celestial Empire. The Expedition of Lieutenant-Colonel Sosnoffsky left Kiakhta with the purpose, amongst others, of exploring the trade-routes from the tea-plantations to the Russian frontier on the Black Irtish. It succeeded in accomplishing its difficult journey, and proceeded from Kiakhta to Peking, Shanghai, and Hankow, passing through the Great Wall by the westernmost gate, and returning across Mongolia to the Zaisan district. But when, shortly afterwards, a caravan, laden chiefly with corn for the Chinese troops, escorted by some Cossacks, was despatched in accordance with the promise of Tso, Governor of the provinces of Shen-si and Kan-su, the Chinese Government, in spite of its promises, and influenced by its usual suspicions, refused the Russian merchants admission to the provinces of Inner China. On this side, therefore, Russian trade cannot penetrate beyond Mongolia, where, at all events, it has not to compete with English goods.

But the question of laying a railroad to Siberia has made more progress, and a line starting from Nijny Novgorod, on the Volga, to Tiumèn, on the Tura, has been, in principle, decided on. We have recently learnt, also, that the Emperor has finally sanctioned the construction of a line of railway from Orenburg to Tashkend—a great work long talked of, which, taking a circuitous course to avoid the steppe, will extend to a length of 1200 miles. On the other hand, internal communications, such as the construction of roads over the mountains to the frontiers of China and improving the navigability of rivers, have hitherto been unsuccessful, owing to the want of trained engineers. It is to this want of trained specialists in all branches of industry, no less than by the large number of its convict population, that the development of so rich a country as Western Siberia has been chiefly retarded.

While on the subject of Siberia, I would add a few remarks to those which have appeared in previous Addresses* on the late Mr. Chekanoffsky's Expedition to the basins of the Yenisei and Lena rivers. From a sketch of the geographical labours of this enterprising and gifted explorer, who was removed by death while the results of his three years' travels were still in course of publication, I learn that the scientific results comprise, in the first place, 108 astronomical, and 57 magnetic observations; secondly, the cartography of regions hitherto comparatively unknown, viz. the great lake system between 67° and 69° N. lat.; the highlands, including parts of the basins of the Olonek, Vilui, Nijny Tunguska, and

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* See vols. xliv. xlv. and xlvi. 'Journal of the Royal Geographical Society.'

Hatanga rivers; and lastly, the whole of the Olonek system, and the region to the east of the Lena. And in precisely similar way localities, concerning which we already possessed more information, are represented in an entirely different light: for instance, the Lena is now for the first time described in full detail; Lake Surung, together with the whole of the Vilui region, as well as the great bend of the Nijny [Lower] Tunguska, were 4 degrees of longitude out of their right position on our maps; and lastly, the earlier surveys of part of the Verkny [Upper] Tunguska, for an extent of 400 versts, were fully 70 compass degrees out of their proper bearings.

But Chekanoffsky's chief object was geology, and in his sketch of the composition of the strata along his line of route he shows that the River Nijny Tunguska, for some distance, flows through Silurian strata, and these are evidently associated with Devonian, and for a considerable distance with the Red Sandstone. Further down, this river flows through trap-rocks, its channel lying for a distance of about 1800 versts (1200 miles) through this igneous formation; but other strata occur with it, containing in some places coal, in others graphite, and these probably belong to the carboniferous measures, as indicated by the vegetable remains found in them. On approaching the Olonek, the trap-rocks still predominate, but before reaching the river, they give place in their turn to the Silurian, here unassociated with Devonian series. These occupy the whole extent of the Olonek Valley to the utmost limits of tree-growth. The valley of the Lena in its upper half is geologically composed of the same Silurian and Red Sandstone strata as are found on the upper course of the Nijny Tunguska. But in its lower half the Mesozoic formations are developed, extending northwards to the shores of the Glacial Sea. The most valuable results of these explorations are in Chekanoffsky's opinion the following:— 1. The discovery of an hitherto unknown region of eruptive rocks of vast extent, exceeding any hitherto known, and continuing through 6° of latitude and 15° of longitude. 2. The acquisition of new stratigraphical and palæontological facts to determine the question of the age of the Red Sandstone, a question more debated than any other connected with the geology of Eastern Siberia; and 3. The determination of the age of the Mesozoic formations of Northern Siberia. But Chekanoffsky also formed valuable collections of animals and plants characteristic of the great tundras, besides making a vocabulary of the language of their Tunguz inhabitants, and these results entitle him to rank as a worthy successor of Middendorf, who alone among men of science had traversed this region on his way to the distant North.

I have to record another loss among Russian Geographers in the untimely death at Vienna, on the 16th of April of this year, of M. Barbot de Marny, whose extensive travels in Central Asia have greatly contributed to extend our knowledge of the geology of the Aralo-Caspian basin, and especially of the region of the Amu-daria.

Barbot de Marny enjoyed a world-wide reputation as a geologist. He worthily supplemented, and in some degree amended, the works of Murchison, Verneuil and Count Keyserling, particularly in the north-east and south of European Russia, and his "Sarmatische Stufe" of Southern Russia will remain a lasting memorial of his learning and scientific attainments.

I learn from Petermann's 'Mittheilungen' that among the most recent additions to the already large mass of information on the Geography of the Pamir is a map drawn by Jehandar Khan,* the deposed ruler of Badakhshan, containing an itinerary from Ush in Khokand, across the Alai Plateau and trans-Alai Mountains, to Lake Kara-Kul, thence in a south-westerly direction to Shighnan (Shaghnán), passing through Vomar and Bir-pandj on the Oxus, before turning towards Chitral *viâ* Wakhan and Yassin. Another itinerary on the same map leads from Hissar *viâ* Kolab to Faizabad.

Another interesting itinerary, communicated by Mr. Veniukoff to the Russian Geographical Society, is from Aksu, in Eastern Turkistan, to Ladak. It is divided into 49 marches, making in all 1328 versts (about 885 miles). This itinerary was found in the archives at Omsk, and refers back to the year 1824.

Of more general interest is a Memoir by J. Moushkétoff on volcanoes in Central Asia.† The author reviews the earlier authorities on the subject contained in Carl Ritter's 'Erdkunde' and Humboldt's later writings, and after comparing these with his own observations on the Ili basin, concludes by denying the existence of active volcanoes in Asia, although he admits the occurrence of extinct volcanoes, such as Pe-shan, north of Kucha, and another north of Kashgar, recently discovered by the late lamented Mr.

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* This chief is mentioned in Col. Montgomerie's report of a Havildar's journey through Chitral to Faizabad, in 1870. See 'Journal of the Royal Geographical Society,' vol. xlii.

† 'Bulletin de l'Academie Impériale des Sciences de St. Petersbourg.

Stoliczka. Amongst other geographical undertakings of Russia in Asia, I can only briefly refer to Captain Pévtsoff's astronomical and barometrical observations along the caravan routes from Port Zaisan to the Chinese town of Guchen; Potanin's explorations in the south-west spurs of the Altai, and the region around Kobdo; and Kostenko's reconnaissance in the Pamir, where Sir Douglas Forsyth and his party have done such good service in the cause of geographical research and exploration. Lastly, I would mention that Colonel Prejevalsky is reported to have succeeded in reaching Lob-nor, and to be exploring the mountains to the south of this lake. It is anticipated that he will return early in July, and we may then look for some interesting particulars of a region never before visited by modern European traveller.

The well-known philologist, Hunfalvy de Meo Koveshd, is at present travelling in Turkistan for the purpose of anthropological studies. Mr. Voiékoff has communicated particulars of his travels in Japan in 1876, and Mr. Miklukho Maklay sends another, and a last instalment of his notes on New Guinea.

Two new scientific Expeditions, as Mr. E. Delmar Morgan (to whom I am indebted for this account of Russian Exploration) informs me, will probably shortly be organised by the Russian Geographical Society: the first, under Mr. Mainoff, will study the Finnish tribes living on the Volga; and the second is intended to explore the water-communications of Siberia, with the view of ascertaining the feasibility of opening a direct water-way between North-Western China and European Russia by Lake Baikal, the Angara, the Yenisei, the Ket, the Ob, and the Tobol.

INDIA.—*Indian Surveys.*—The first Report of the new Department of Indian Marine Surveys has been submitted by the Superintendent, Commander A. D. Taylor, late I.N., and has been deemed of sufficient importance and interest to warrant its being reprinted in this country as a Parliamentary Paper. The Report touches upon the period of absolute inactivity in Coast-surveying which succeeded the abolition of the Indian Navy in 1861. For ten years the wants of the Mercantile Marine frequenting the Indian ports were neglected by the discontinuance of those surveying operations, which had been one of the chief functions of the Indian Navy. In 1871, Mr. Clements R. Markham, C.B., our Secretary, drew the attention of the Duke of Argyll, then Secretary of State for India, to the pressing need of some organized agency for providing for this end. The fact was, that since the execution of the surveys then in use, many of which dated from thirty to fifty years back, extraordinary changes had taken place in the configuration of the coast; lights, buoys, and beacons had been erected; and ports, of little or no importance then, had become regularly open to commerce. Many of the surveys of a century before had been mere preliminary examinations not to be compared with the rigorous Royal Navy surveys of the present day, carried out with steamboats and trained officers.

After some delay, the Government finally took up the question in 1873, and requested that Commander Taylor should be deputed to India to advise them on the subject. It was on the 16th of July, 1874, that official sanction was given for the formation of the new Department called "The Marine Survey Department." Commander A. D. Taylor, late I.N., was created Superintendent, and six experienced Navigating Officers of the Royal Navy were lent by the Admiralty for service under him. Besides these, a few officers of the Bengal and Bombay Marines were engaged in India, and an experienced official of the Admiralty Hydrographic Office was created Superintendent of the Drawing and Compiling Branch.

The chief surveys executed by the new Department up to the end of 1876 comprise the following:—Kolachel Harbour and the Enciam Rocks in Travancore, Coconada Bay and the lower part of the Hooghly River, including the James and Mary Shoals, the approaches of the Rangoon River, Akyab Port and False Point anchorage. The Department sustained an unfortunate loss by the death of one of its Royal Navy surveyors, Lieutenant C. George, a young officer of promise, and son of Staff-Commander George, R.N., our Map Curator. During the spring of 1876, Commander Taylor made a tour of inspection along the Burmese coast, which resulted in the detection of many errors in the existing chart, and in a determination to have the important port of Amherst properly surveyed at the earliest opportunity. A valuable list of light-houses and light-vessels along the coast of British India has been compiled on the model of the Admiralty List; and Commander Taylor's Department has further proved its usefulness by rendering advice to Government on a variety of marine subjects.

The Great Trigonometrical Survey of India completed during the years 1875–6 an out-turn of 4182 square miles, while an area of some 9000 square miles was covered by secondary triangulation, 3500 square miles of it being closely covered with points for the topographical surveyor. Topographical operations by the same departments have been conducted in Dehra Dun, including the Siwalik Hills, and Jaunsar Bawar, Kattywar and Guzerat; and the area achieved has been 1047 square miles on the scale of 4 inches to the mile, and 3629 square miles on the scale of 2 inches to the mile. Three separate surveys have been brought to completion; these being the Jodhpur Meridional series of principal triangles on the meridian of 72½, running through the Jodhpur, Jesalmir and Bikanir States of Rajputana and Bhawalpur; the topographical survey of the beautiful valley of Dehra Dun, including its outlying subdivision of Jaunsar Bawar and the Siwalikh Hills; and the Ceylon Connecting Series, by means of which complete unity can now be introduced between the Surveys of Ceylon and India, and through which the recent telegraphic measurements in uniting India and Greenwich longitudinally will have established a similar connection for Ceylon. Spirit-levelling operations, chiefly in Cutch and Kattywar, have been carried over 421 linear miles, and three stations for tidal observations on the north shore of the Gulf of Kutch have been connected by levels; the result of the determination being to indicate that the mean sea-level stands progressively higher, as the tidal station is removed from the open-sea further up the Gulf. The usual activity has been shown in the computations and publications of the Department, the general Report of which has been issued by Mr. J. B. N. Hennessey, M.A., F.R.S., who officiated as Superintendent during the absence on furlough of Colonel J. T. Walker, R.E., F.R.S.

In connection with the foregoing should be mentioned the retirement from the service of Colonel T. G. Montgomerie, R.E., F.R.S., late Deputy-Superintendent of the Great Trigonometrical Survey, who, as a Gold Medallist of this Society, has a peculiar claim on our notice. Colonel Montgomerie's service in the Department, from the date of his entry thereinto in 1852, has been one of signal usefulness, and his labours in connection with the successful trans-frontier explorations, conducted by natives trained under his eye, will always be remembered.

In the Indian Topographical Surveys Section, nine parties were at work during the year 1876–77, and a highly satisfactory out-turn of 19,188 square miles was achieved, this being principally on the 1-inch scale. Two of the parties broke ground in the State of Mysore, where accurate surveys have for some time past been needed. The large reductions which have been recently sanctioned in the Survey Department have already begun to have their effect in preparations for the absorption of two topographical parties during the present year; while in the Revenue Survey branch, eleven parties instead of fourteen have been employed during the season 1876-77, which is just coming to an end. The Government contemplate in this manner to bring the estimates of the whole Survey Department eventually down to 20 instead of 24 lakhs of rupees per annum.

In the Compiling and Engraving branches of the Surveyor-General's office progress has been made in the preparation of general maps of India, the Lower Provinces, Sind, Oudh and Assam. A map of Baluchistan, on the scale of 16 miles to an inch, has been published, and a new map of the countries between Hindustan and the Caspian Sea, on the scale of 64 miles to an inch, is under preparation. The natives employed on hill-etching continue to progress, but require the constant help and supervision of the European staff, a state of things which causes great delays in the work of the latter.

The total number of parties engaged on Revenue Surveys amounted to 17, and the total area surveyed was 11,175 square miles, on scales varying between 32 and 2 inches to a mile. Strenuous endeavours have been made to utilise the maps of the Bombay Settlement Surveys for incorporation as far as possible in the Topographical Survey-sheets, but, up to the present, the results have proved failures, owing to the great inaccuracy of the former.

A very interesting index-map has been published by the Surveyor General of India in his Report, showing the progress hitherto made by the different branches of the Survey Department towards the completion of a first survey of all India. Rajputana, Nepal, the North-West Provinces, the Konkans, and the whole Southern half of the peninsula are still conspicuously blank, but it must not be forgotten, that though not strictly and scientifically accurate, Atlas-sheets of these provinces *are* in existence. Indeed, the activity and energy with which the survey of our great Indian Empire has been pushed on for many years by the present accomplished head of the Department, deserves the warm recognition of geographers.

Trans-Himalayan Explorations.—"The Havildar," whose former remarkable journey into Badakshan, in 1870, was recorded by my predecessor in the Address for 1872, has been again engaged in making a similar route-survey from Kabul to Bokhara. He left Peshawur on the 19th of September, 1873, with two companions, travelling in the disguise of a merchant, with about 300*l.* worth of muslins and cloths. Leaving Kabul on the 3rd of November, and crossing into Badakshan by the Sar-ulang Pass, about 12,000 feet above the sea, he arrived on the 19th at Faizabad, the modern capital of Badakshan, where he passed the winter. On the 19th of April, 1874, he set out from Faizabad with a stock of *churrus* (an intoxicating drug made from the hemp-flower) for sale, and reached the left bank of the Oxus, where he crossed the river on a raft made of inflated skins, the stream being 600 paces wide. The Oxus here separates the dominions of the Amir of Bokhara from those of the Amir of Afghanistan, and from this point upwards it is generally known as the Punjah. Next day the Havildar arrived at Kolab, a city of 600 houses, where he remained until the 25th of May. He then travelled along the right bank of the river into Darwaz, and arrived at Kila Yaz Ghulam, the frontier village of that little state, on the 9th of July. He was told that, from this point, one long day's journey would have brought him into Shighnan; but he was recalled by the ruler of Darwaz, and detained at its chief town of Wanj for three weeks. He was then told that he would not be allowed to continue his journey, but must return to Kolab; he consequently went back to Faizabad, and thence, by Balkh and Bamian, to Kabul, reaching Peshawur on the 11th of January, 1875.

Another of the native explorers, trained by the Trigonometrical Survey Department, a native of Peshawur, surnamed "the Mullah," accompanied the Havildar as far as Jalalabad, on his outward journey. He is described as a well-educated man, skilled in Arabic, and able, in his capacity of Mullah, to travel unquestioned in such dangerous districts as Swat and Chitral. He left Jalalabad on the 28th of September, 1873, crossed the Kabul River, and proceeded up the valley of the Kunar, of which he has given a very valuable description. He reached Chitral on the 31st of October, passing the winter there. On the 22nd of March he set out for the Baroghil Pass, which is believed to be the lowest depression in the chain that separates India and Afghanistan from Northern Asia. This pass forms the water-parting between the Sarhadd and Chitral Rivers; the Mullah crossed it, and reached Sarhadd, in Wakhan, on the 8th of May, 1874. He then proceeded over the Little Pamir to Tashkurghan and Yarkand, and so by the Karakorum Pass to Leh. He merely made a route-survey with compass, without attempting observations for latitude or height above the sea, as detection would have been a most serious matter.

These two journeys, performed by "the Havildar" and "the Mullah," were complements of the work achieved by Captain H. Trotter, R.E., of the Great Trigonometrical Survey, who accompanied the Mission of Sir Douglas Forsyth to Kashgar as Geographer. A few words regarding the geographical work performed on that Expedition by Captain Trotter will be necessary in this place. On his outward journey he made an interesting boat-expedition on Pangong Lake in October 1873, obtaining soundings of this elevated sheet of water; and surveyed the routes between Ladak and Eastern Turkistan. From Kashgar he made important explorations to the north as far as the Chatyr Kul. He then proceeded on his important journey, by way of Tashkurghan, to the Pamir Steppe, where he obtained a complete set of astronomical observations, and was thus enabled to fix the principal positions along the line of march with considerable accuracy. In this journey Captain Trotter started from Kashgar on the 17th of March, 1874, accompanied by Dr. Stoliczka, the Geologist, passed through Tashkurghan, and reached Panjah in Wakhan. Here he despatched his assistant, Abdul Subhan, to explore the course of the Oxus from this point in the direction of Kolab. He followed the river for 63 miles to Ishkashim, thence, turning northwards, he continued his journey along the river-bank for nearly 100 miles, passing through the districts of Gharan, Shighnan, and Roshan—countries which have hitherto been known to us hardly even by name. He describes the famous ruby-mines, and gives many particulars respecting the countries of Shighnan and Roshan. The Munshi Abdul Subhan succeeded in reaching a point very near to that at which the Havildar, coming from another direction, was obliged to turn back. Captain Trotter left Panjah on the 26th of April, 1876, and marched up the northern branch on to the Great Pamir, reaching the west end of Wood's Victoria Lake, the source of the Oxus. Captain Trotter's valuable Report has thrown a flood of light on the geography of the Pamir and of Eastern Turkistan, and it is gratifying to find that his determination of the position of the Victoria Lake is practically identical with that of Lieutenant Wood.

The reductions of the astronomical observations and the computations of heights were all made in the office of the Superintendent of the Great Trigonometrical Survey; and, among other results, a series of most valuable maps has been prepared. For Captain Trotter has not only worked out his own observations, but has also reduced those of the Havildar and Mullah, as well as those of the Pundit, Nain Singh, whose recent very remarkable journey through Tibet earned for him the Patron's Royal Medal, which has been this day publicly awarded. These native explorers did good service in the field, but, for the resulting narratives and maps, Geographers are indebted to Captain Trotter, as they were for the results of former journeys by native explorers to Colonel Montgomerie.

Regarding Nain Singh, the most distinguished of these native explorers, an account of whose latest journey, from the pen of Captain Trotter, was read before us at our last Meeting, I may add that his training as a traveller and topographer had extended over thirty years. His first experience was gained in the service of those two eminent and scientific officers, Richard and Henry Strachey. In 1856 and 1857 he was employed by the brothers Schlagintweit, whilst they were engaged in carrying on their magnetic and other observations in Ladakh and Kashmir. After some years' interval, during which he was usefully occupied in education as Head-master of a Government-school in his native district of Milam in Kumaon, he was, in 1863, taken into the employment of the Trigonometrical Survey, at the instance of Colonel Walker, and trained as an observer for topographic work in the countries beyond the Indian frontier. Since then, he has carried out with patience, intelligence, and perfect success, and at the peril of his life, a number of important Expeditions.

In 1865-66, he made his first important essay in exploration by his celebrated journey from the capital of Nepal to Lhasa; and thence he ascended the whole course of the Great River of Tibet to the region of Mansarowar Lake, a space of 10 degrees in longitude, and back to India. Though Lhasa had been reached two or three times at great intervals, during the two preceding centuries, by European travellers, none of them were practical Geographers, or had left us any geographical data; whilst the value of the observations by Chinese or Tibetan employés of the Jesuit Fathers, which formed the basis of this part of D'Anville's Atlas, has always been subject to great doubt. Nain Singh's determination of the true position of that celebrated city, as well as that of its approximate altitude above the sea, was therefore, practically, the first.

But, besides this, his elaborate route-survey of new country extended to some 1200 miles, his observations for latitude fixed that of 31 places, and those for altitude gave the approximate height of 33. He brought back, in addition, a very intelligent and interesting Diary, of which the substance is given by Colonel Montgomerie in the 38th volume of our Society's 'Journal.' Every means of judgment and comparison that could be applied resulted in showing that the Pundit's observations were most careful and trustworthy, though often made, as may be conceived, under circumstances of extreme difficulty, and straining ingenuity to obtain opportunity for making them at all.

For this great journey and its results, the Pundit received a Gold Watch from our Society in 1868. It cannot be said that his *name* became famous, for his name was necessarily suppressed, and unknown till recently, even to our Society. But, under the title of "The Pundit," his reputation spread over Europe.

In 1867, Nain Singh, with two comrades, made a second valuable journey on the Tibetan Plateau, in the vicinity of the sources of the Indus and Sutlej, and beyond them. Of this journey, also, the narrative, published in the 39th volume of our Society's 'Journal,' is full of interest.

Leaving minor services unnoticed, I pass on to the Pundit's crowning work as an explorer. Having accompanied Sir D. Forsyth's Mission to Kashgar, in 1873, without finding opportunity for detached employment, on the return of the party to Ladak he volunteered to go on a fresh journey of exploration. This journey, if not quite so important as that which earned his first fame, was over a field even yet more arduous, and less known. His route lay from Leh to Lhasa, by a line further north than any previously known, and, in fact, across that part of the high plateau of Tibet which is almost a blank in our maps. In the course of his journey he discovered an extensive series of lakes and rivers, as well as a vast snowy range to the north of the Tibetan course of the Brahmaputra.

His stay at Lhasa was cut short by circumstances of danger, and, after having determined the course of the Brahmaputra to a point very much lower than any that had yet been ascertained, he struck across the Himalaya southward, and entered Assam by the Tawang Pass, a route hitherto quite unexplored.

The total length of this journey from Ladak to the frontier-post of Assam was 1319 miles, and about 1200 miles of this lay through what may most justly be called *terra incognita.* His observations for latitude and longitude were more numerous than ever. This great and toilsome feat appears to have closed the Pundit's career of exploration. Though not far advanced in years, his constitution is stated to be worn out, and his sight impaired by protracted exposure and incessant observation, in those harsh climates and at those vast altitudes. Such are the achievements which our Society has desired to recognise by its Medal.

NEW GUINEA.—An important journey in the interior of New Guinea has been performed during the past year by Signor D'Albertis, the well-known Italian naturalist whom my predecessor mentioned in the last Anniversary Address as having accompanied Mr. Macfarlane, in the London Missionary Society's steamer, on his voyage up the Fly River. On his return from that preliminary journey, Signor D'Albertis visited New South Wales, and was there furnished, by the liberality of a number of wealthy residents of Sydney, with the means of undertaking a further exploration of this greatest known river of New Guinea. A small steam-launch, named the *Neva*, of only 12 tons burthen, was provided for him, and leaving Sydney on the 20th of April, 1876, he commenced his ascent of the river towards the end of May, with a crew of ten men, three only of whom were Europeans. The journey up the stream was continued with varied adventure, but without serious accident, until the 28th of June, by which day he had reached a point in S. lat. 5° 30′ and E. long. 141° 30′, about 500 miles from the mouth, following the windings of the river, a distance far exceeding that attained by Mr. Macfarlane in the *Ellangowan* in the previous year, which was only 160 miles. At the farthest point reached, Signor D'Albertis reports the Fly River to be in some places only 25 or 30 yards wide, and very shallow in places; indeed, it was owing to the stream in dry weather being too shallow for his little launch, which repeatedly grounded on gravelly banks, that he was forced to abandon his enterprise; his intention, at starting, having been to cross by land to the opposite northern coast of the island, should the river prove navigable, to a distance of not more than 200 miles from the coast. The navigability ceased, however, at 400 miles from the northern side, and the land journey had to be abandoned. The rapidity with which the height of the water rose and fell, according as the weather was rainy or dry, shows that the traveller could not have been very far from the sources of the stream; and the swiftness of the current after heavy rain was one of the chief difficulties he had to overcome in steaming against it. The anxieties and labours of the navigation, and the impassable nature of the dense forest which clothes the banks of this great river, prevented Signor D'Albertis from adding so largely as he had expected to his natural history collection, and the same causes prevented his making any geographical *reconnaissance* beyond the immediate banks of the stream. He endeavoured to get views of the country by ascending the small eminences accessible from the banks; but at the point where he turned back no high land was in sight, the highest hills observed around averaging only from 300 to 400 feet. But lower down the river he discerned from the top of a hill, 250 feet high, some very high mountains at a distance estimated at 50 or 60 miles. As far as native population is concerned, Mr. Macfarlane's experience appears to have been confirmed, namely, that it is only the broad reaches near the mouth of the river that are at all well peopled. Beyond 100 miles, native houses and natives seem to have been very rarely met with, and the natives in almost all cases forsook their houses or their villages on the approach of the strange visitors.

In April of last year, Mr. Macfarlane made an interesting voyage in the *Ellangowan* steamer from Port Moresby to China Straits and Possession Bay, at the south-eastern extremity of New Guinea, and made some discoveries of islands and harbours in this varied and picturesque region, which will form a valuable supplement to the result of Captain Moresby's memorable survey. The Rev. Mr. Lawes, an observant and zealous member of the London Missionary Society's Mission, takes an active part in these explorations, which are being undertaken with a view of ascertaining the best sites for Mission stations in New Guinea. He accompanied Mr. Macfarlane to China Straits, and has recently communicated an account of a subsequent visit to Point Hood, in the neighbourhood of which he discovered a fine river, 100 to 150 yards wide, which has its source on the slopes of Mount Astrolabe.

AUSTRALIA.—Mr. Ernest Giles, whose remarkable journey through the interior of Western Australia, from east to west, was recorded in the last year's Address, has since followed up his success by re-traversing this inhospitable desert from west to east, in a more northerly latitude than his previous route. Leaving the coast at Champion Bay in March 1876, he crossed the watershed of the Murchison and other rivers, and reached the head-waters of the

Ashburton in about lat. 24° s., whence he struck across the desert, passing a little to the south of Lake Amadeus, and reaching the line of overland telegraph at Mount O'Halloran. His line of march lay on the average about a degree and a-half to the north of Forrest's route.

NORTH AMERICA.—The surveys undertaken by various official departments of the United States continue to afford important contributions to our knowledge of the geography of North America; and, in connection with the purely geographical portions of these explorations, it is especially noteworthy that Transatlantic Government advisers are conspicuous for the breadth of their views in scientific matters, as mere triangulation and mensuration operations form but a small part of the published results, which include original Papers by competent authorities on the geology, palæontology, meteorology, ethnology, philology, zoology, and botany of the districts traversed.

Professor Hayden's Report of his operations in Colorado, published during the past year, is probably the most exhaustive of these surveys. The entire circuit of Colorado has now been made by his parties, and the altitudes fixed of the highest peaks of the Rocky Mountains (Blanco Peak, 14,464 feet, being found to overtop all the rest). The topographical portion of this Report is comparatively small; but the accumulation of facts in every ancillary branch of science is, as usual, astonishing, especially when it is remembered that this profusely-illustrated volume (of some 500 pages) is but one of a series issued as fast as circumstances will permit by the office of the Geological and Geographical Survey. This department has in addition published various separate parts of its "miscellaneous publications," containing much local geographical matter, and of its 'Bulletin,' of which the second volume is now well advanced; it has also recently issued three thick 4to. volumes on Palæontological and Natural History subjects connected with the survey, and all illustrated by very numerous plates and maps. Besides these, the special work of the survey has resulted in a considerable advance in the progress of the Physical Atlas of Colorado, of which, according to the President of the American Geographical Society, 6 sheets, comprising some 70,000 square miles, will be issued shortly.

In connection with these operations, Professor Powell has surveyed 7000 square miles of the east, and 4000 square miles of the south-west and south-east of Utah, resulting in an accurate knowledge of the small capabilities of that district for agricultural purposes, owing to the slight rainfall, and of its rather more promising mineral resources.

Lieutenant Wheeler, of the Engineer Department, United States Army, has continued his surveys west of the 100th meridian, in Nevada, New Mexico, and California, traversing 25,000 square miles, of which 9000 were in New Mexico, south-east of Santa Fé. His special aim appears to have been the investigation of the practicability of diverting the River Colorado so as to irrigate the desert lands of South-East California; and he appears satisfied that a canal could be constructed by which 1600 square miles could be flooded. Thirteen atlas sheets of this survey have now been issued, on scales of 8 miles and 4 miles to the inch, covering a large part of Nevada, Utah, Arizona, New Mexico, and Colorado. Lieutenant Wheeler's general Report is of a very comprehensive nature; and he has also issued two thick 4to. Reports on the geology and zoology of the survey, with many coloured plates, maps and photographs.

An accurate survey of the great North American lakes has been carried on by General C B. Comstock, of the United States Engineer Corps; in the course of which the precise elevations of Ontario and Erie have been defined. Accurate positions have also been determined for each of the West Indian Islands by the Hydrographic Bureau; the coast survey of the Gulf of Mexico has been continued; and the continental triangulation has been pushed eastward from the Pacific coast ranges to the Sierra Nevada.

In referring, however briefly, to the geographical work of our Transatlantic brethren, it must be considered a fitting opportunity to offer our congratulations to the American Geographical Society, which, incorporated in 1852, has now fully attained its majority; and the occasion is the more appropriate, as the Society has recently acquired a new and commodious home, for which it is indebted to the public spirit and liberality so characteristic of American citizens. Under the able direction of its distinguished President, Chief Justice Daly, whose eloquence and heartfelt regard for our favourite science cannot fail to have impressed his hearers during his late visit to this country, the American Geographical Society now numbers 1750 Fellows, and possesses a geographical library of some 10,000 volumes and a large collection of maps, &c.

Geographical operations on a large scale have been engrossed by the State in America; but the numerous and valuable papers contained in the 12 volumes of 'Proceedings,' 'Bulletins,' and 'Journals' issued by the Society since 1852, sufficiently attest the vitality of Geography in the country at large.

SOUTH AMERICA.—Four papers descriptive of travel and research in remote and little known parts of the interior of this continent have been contributed to the Society during the year. Two of these, viz., Mr. Bigg-Wither, "On the Valley of the Tibagy," and Mr. Wells, on his journey from the Rio St. Francisco to the Upper Tocantins, will appear in our 'Journal,' with original maps furnished by the authors. A third paper, containing accounts of the remarkable journey of Mr. Alfred Simson across the dense forests of Ecuador, from the Pastaza to the Napo, and of his voyage of 1200 miles up the River Putumayo, will appear in the next number of our 'Proceedings.' The fourth is entitled, "Notes on Bolivia, to accompany original maps presented to the Royal Geographical Society," and is written by Mr. Musters, who distinguished himself a few years ago by his adventurous journey through Patagonia. All these papers will aid materially in filling up the still numerous gaps in our knowledge of this great continent, and supplement the work that is being carried on by the different governments.

AFRICA.—Africa has been the subject of discussion at four out of fifteen meetings held since our last Anniversary. The following papers have been read on this inexhaustible theme.—"The District of Akém, West Africa," by Captain J. S. Hay; "The Khedive's Expeditions to the Lake Districts," by Colonel Gordon, R.E.; Gessi's "Circumnavigation of Albert Nyanza;" and "The Livingstonia Mission at Nyassa," by Mr. Young; besides which numerous announcements have been made regarding other expeditions. We have also seen, in the columns of the 'Daily Telegraph,' the graphic letters of Mr. Stanley, the Correspondent of that Journal and of the 'New York Herald,' in Central Africa.

Colonel Gordon's Expeditions.—Under the instructions and personal superintendence of this officer, a complete scientific survey of the Nile has been made, commencing at Khartum, and ending at a point 40 miles distant from the northern end of Victoria Nyanza—a survey altogether of 1500 miles of river. Three officers of our Royal Engineers, with M. Gessi, have accomplished this, namely, Colonel Gordon and Lieutenants Watson and Chippendall. The "suds," course, current, width of the river—the rocks, rapids, and nature of the country—have been laid down with minuteness, and two maps, on the scale of 35 miles to an inch, have been prepared for our Society from the original drawings of the above officers. These maps will remain as standard references.

Romolo Gessi has circumnavigated the Albert Lake with two iron boats built by Samuda Brothers, and states it to be 141 miles from north-east to south-west, and from 40 to 60 miles across. Leaving Dufli by boat on the 7th of March, 1876, he arrived at the mouth of the Lake on the 18th of March. The slow progress up this part of the river he attributed to contrary winds, incessant rain, and river-currents. The distance is 164 miles, along a deep, broad, navigable river, exceeding 700 yards in certain places with a large population and a productive country on the western bank. From the mast-head of his cutter-rigged boats he observed hills and cliffs in the distance. On the shores of the Lake, forests of ambatch were of frequent occurrence. The people on the western shore were not friendly, sounding their war-drums and carrying their property away; however, M. Gessi was able to hold conversations with a few natives, the result of which seemed to prove that he had reached the farthest extremity of Albert Lake, and that there is no river feeding its southern extremity. At the same time, the mountains which he saw on either side of the Lake appear not to meet at the south end, and there may exist a passage for water to the south, though it was not observed, from the quantity of ambatch growing there.

M. Gessi remained on the Lake from the 18th of March till the end of April; a period of stormy equinoctial days, for he experienced constant rain and high winds. He has proved without a doubt that the Nile descends from Victoria Nyanza, enters the Albert Lake, and flows from it, at fourteen miles farther north, to Dufli; thus setting finally at rest the question of the direct connection of the Nile with these great Lakes. This question was rashly disputed by Dr. Schweinfurth (see President's Address of last year), although maintained by the late Captain Speke, and confirmed by Sir Samuel Baker. From the smallness of his escort, and the uncertain character of the people, M. Gessi did not examine the interior of the country, neither could he closely observe the streams flowing into the Lake on the eastern and western shores, but he reports several waterfalls and bays, where the colour of the water indicated the proximity of considerable streams.

Carlo Piaggia accompanied M. Gessi from Dufli to Albert Lake in 1876, thence he proceeded alone up the Nile, and examined the new Lake, or back-water of the Nile, discovered by Colonel Long, near M'rooli. This has since been visited by Colonel Gordon himself, who has sketched its outline, as far as he observed it, on the map presented to the Society, which is published in the present volume of the 'Journal.' Respecting other travellers in this part of Africa, I may mention the following:—Signor Marno, after endeavouring to push south to the Balegga Mountains had returned to Egypt. Mr. Lucas intended to have proceeded to the head-waters of the Congo from Gondokoro; but severe illness prevented this, and the unfortunate traveller died on his way to England, as I have had occasion to relate in the Obituary notices at the commencement of this Address. Dr. Schrietzer (Emin Effendi) had visited King M'tesa of Uganda, was well received, and confirmed the previous observation of Mr. Stanley that the King was favourable to Christianity.

The Khedive of Egypt has recently given to Colonel Gordon supreme command over all the Soudan, from the second cataract, including Khartum, to the Equatorial region, with the view of suppressing slavery and developing all lawful commerce. He has appointed him to negotiate a peace between Egypt and Abyssinia, and with this view Colonel Gordon has been at Massowah for some time; but this object is not accomplished, and we hope to hear of his having taken up his Governor-Generalship of all the Soudan.

General Stone, the chief of the general staff at Cairo, has kindly reported to our Society the various reconnaissances which have been made under his orders and those of Colonel Gordon in Egyptian territory; the most notable of which are:—Reconnaissances of country adjacent to the White Nile, by Colonel Long; Kordofan, &c., by Colonel Colston and Major Pemberton; Darfur, &c., by Colonel Purdy. Botany of Kordofan and Darfur, by Dr. Pfund. Topography and geology, by Mr. Mitchell; besides surveys, soundings, &c., by numerous other officers of the Egyptian staff.

Stanley's Expedition.—The Address of last year left Mr. Stanley to explore the then unknown south-western corner of Victoria Lake, between the Kitangule River and Jordan's Nullah of Speke. He had discovered the Shimeeyu River, which was "considered the true source of the Nile—that is, the most southern feeder of Victoria Nyanza;" but his recent letters inform us that a still more important river, the above-named "Kitangule," now claims this honour. Mr. Stanley has visited the Albert Lake, and circumnavigated Lake Tanganyika.

Between July 1875, and August 1876, Mr. Stanley traversed by water, or on foot, from 1200 to 1500 miles; that is to say, he made about 4 miles daily, inclusive of halts, which is unusually fast travelling in the interior of Africa. Since his letter of the 15th of May, 1875, alluded to in last Address, the following have been published, giving detailed accounts of the countries he has visited.—Dated 29th July, 1875; 15th August, 1875; 18th January, 26th March, 24th April, 7th, 10th, and 13th August, 1876.

Pocock's letters are dated as follows —14th August, 1875; 18th April, 1876. Ujiji, 21st July, 1876; 23rd August, 1876.

Stanley's letter from the Island of Bambireh, Victoria Nyanza, describes to us, with a map, the south-western corner of the Lake. Here are figured thirty-eight islands, from 1 to 10 miles from the shore; and the largest of them, Bambireh and Romeh, 12 miles in length by 2 or 3 in breadth. Two soundings appear upon the map, near Alice Island; the one next the shore is 166 feet, and the other, 15 miles to the south-east, is 338 feet; showing that this lake is navigable for any ship afloat. Having returned to his head-quarter camp at Kagehyi, he again crossed in a north-westerly direction to Dumo, in Uganda territory, and proceeded under a Waganda escort to explore the country between the Lakes Victoria and Albert. On entering Unyoro territory the people naturally were not friendly to Waganda soldiers, and Mr. Stanley had no opportunity of navigating the Albert Lake, through the timidity of his Waganda, who feared the dense population of Wanyoro. But he reached a bay of the Lake, which he named "Beatrice;" and, compelled to give up all hope of navigating it, he turned his attention to the south, and after several days crossed the River Kitangule, for the Arab settlement of Kufuro, in Karagweh. Mr. Stanley's opinion of the Kitangule Kagera is as follows —"While exploring the Victoria Lake, I ascended a few miles up the Kagera, and was then struck with its volume and depth; so much so, as to rank it as the principal affluent of the Victoria Lake. In coming south, and crossing it at Kitangule, I sounded it, and found it 14 fathoms, or 84 feet deep, and 120 yards wide." This river will be recognised as the same which was crossed in 1862 by Captains Speke and Grant, and which they reported as a majestic navigable river from the Akenyara Lake.

While under the kind care of King Rumanyika, of Karagweh, Mr. Stanley made many important journeys to the west and south of the kingdom, visiting this great Lake district, and region of conical mountains and hot-springs, full descriptions of which I must ask you to refer to in his graphic letters. From here he traversed the districts of Western Unyamwezi; and we next find him on the 27th May at Ujiji. After a fortnight's arranging, Mr. Stanley left his heavy baggage in charge of Pocock on the 11th June, and proceeded to circumnavigate the Tanganyika Lake for fifty-one days. He estimates the Lake to be 800 miles in circumference, and 19 miles longer than Commander Cameron reckoned it. The Lukuga Creek, of Cameron, was examined during four days. The broken cane in the bed of the creek denoted to Mr. Stanley that any water must flow into the Lake, and not out of it; and he considers that the Lukuga has never been an outlet, and is not at present one, but that it will be the "waste-pipe" of Tanganyika in a few years, when the Lake begins to overflow. He tells us that Mr. Cooley's idea of there being a connection between Tanganyika and Nyassa Lakes is as absurd as Livingstone having separated Liemba from Tanganyika, Baker having married the Albert and Tanganyika, or Speke having made an island of a promontory (Ubwari). Mr. Stanley raises an interesting question as to the name and derivation of the word Tanganyika, saying that travellers have fallen into mistakes through the circumstance of the name of the country being applied to the Lake. At Liemba the Lake is not called Tanganyika, or *vice versâ.* The derivation of the word, according to Mr. Stanley, is "Plain-like Lake;" but this is not accepted as the true interpretation. Nyika is used as a proper name in Africa, and as portion of one, as Rumanyika; also, it is applied on the native routes west of Bahringo by the Rev. T. Wakefield as Mtanga-nyiko, which undoubtedly implies a swampy region. It signifies the floating water-plants, which produce edible roots—the "Singhara" of India, *Trapa natans;* and from the fact that this plant exists plentifully in Africa, and that quantities of floating vegetation were seen by the late Dr. Livingstone opposite Ujiji, it may be taken as the more probable interpretation of the two, namely, from *Tanganya,* to gather; and *Nyika,* (?) nuts: that is, "Tanganyika," meaning "collection of water vegetation," or "the habitat of the water-nut."

Mr. Stanley writes of "my discovery of the new lake and river," which he ventures to name the "Alexandra Lake and River." He tells us that "he could not see this lake from his mount of observation because the Mountains of Ugufu intercepted all view of it; but his guides assisted him to understand the position of the Lake." This water, we are told, has three outlets—two flowing to the east towards Kitangulo, and the third to the south, joining the Ruzizi Lake, which is made to discharge to Lake Tanganyika. This requires inspection, which we hope will soon be made by the Mission party who have proceeded to Karagweh; and if a reference be made to Speke's map in vol. xxxiii. of the Society's 'Journal,' this Lake Akenyara, which Mr. Stanley proposes to name Alexandra, will be found laid down 27 miles by 4½. The total length of this river is 200 miles according to Speke, and 310 miles, "and perhaps as many more," according to Mr. Stanley; while the Shimeeyu is calculated at 229 miles.

One other remark regarding the Kagera. Mr. Stanley tells us that during the dry season it exceeds in volume the "Thames and Severn united, and is 70, 80, and 120 feet in depth, with a width of 150 to 200 yards; and, as it passes through the shallow Lake Ingezi, which is 5, 10, and 14 miles in width, it sustained its depth of 40 to 60 feet." But whether this river, or the Shimeeyu, or any other river flowing into the Lake, is to be considered a source or not—among so many, and all so distant from the Nile—the honour will still remain with the parent-mother Victoria.

My own opinion on this subject is much in accord with that of a well-informed writer in the 'New York Sun' of the 15th of March last, and I cannot, perhaps, do better than quote his words:—"That he has verified Captain Speke's delineation of the Victoria Nyanza, only proves the excellent geographical results achieved by that officer; and Mr. Stanley deserves every credit for the minute survey he has made of the Lake, which confirmed the accuracy of Captain Speke's hypothesis. It is a pity he should not have been content to rest upon these laurels. Instead of this, he has assumed that if he can find out which of the numerous tributaries flowing into the Victoria Nyanza is the largest and longest, he will be entitled to claim that as the Nile. First, he found the Shimeeyu, and called that the source of the Nile. Unfortunately he afterwards came upon a much larger affluent, called the Kagera, which entirely extinguished the Shimeeyu, and then he called that the Alexandra Nile. But this river had been examined by Speke and Grant; and it is a gross violation of all etiquette among explorers for a new name to be given to it by a gentleman who visits it fifteen years after its first discovery, and calls it the Alexandra Nile, in order that, should he ever discover its source, he may claim to have discovered the source of the Nile. In the first place, it is not the Nile, any more than a stream running into Lake Superior can be called the St. Lawrence; and in the second place, if it was the Nile, he has not discovered it. This he frankly admits. Had he read Captain Speke's book he would have found that that officer fully appreciates the importance of the Kagera River as probably the largest affluent of the Victoria Nyanza; but he judged, and judged rightly, that where a huge lake is fed by hundreds of affluents, several of which are nearly of a size, the river that runs out of it is not the same river as any one of those affluents. . . . The true Nile only begins where it issues from the Lake."

"Mr. Stanley would also have found, had he had Captain Speke's book with him, that he advances nothing new with regard to the watershed on the west of the Victoria Nyanza. Speke lived for several weeks at Rumanyika's, almost on the banks of the Kagera, and within 50 miles of the Lake which Mr. Stanley never saw, but of which a map is given in the 'Herald,' as though he had discovered it, and which, not having discovered, he has no right to call the 'Alexandra Nyanza.' The proper name of this lake is Akenyara, and it is to be found carefully delineated in one of Speke's maps. 'What I could not see,' says Mr. Stanley, 'because of the mountains of Ugufu, was Akenyara, but my guides assisted me to understand tolerably well the position of the Lake.' Hereupon exclaims the 'Herald:' 'The grand problem of the geographical era, which may be said to have commenced with the days of Ptolemy, has been the discovery of the sources of the Nile. To solve it many explorers have essayed and failed, leaving to Henry M. Stanley the palm of the victor, the glorious prize of success!'"

Although I should not have expressed myself exactly in these terms, I concur in the justice of the opinion here given of the want of originality in these so-called discoveries. It should, however, be said that since Speke and Grant gave no names of their own to either lake or river, but merely recorded the native names, the deviation from good taste and usage in any later explorer—who as regards the river had really navigated some 100 miles of its course—to give it a name of European origin is not wholly without precedent or justification, whatever may be said as to the lake which he only took on native report, and never saw. I may cite here the precedent afforded by Speke himself, who gave the name of Victoria to Lake Ukerewe; and, still nearer the point, that of Sir Samuel Baker, who re-named the "Little Luta N'zige" of Speke, the Albert Nyanza.

Mr. Stanley, when his last letter was written, had been suffering after his long cruise, and the natives around him were dying of small-pox, at the rate of forty to seventy per day. But he was to leave on the 24th of August last, by crossing the Lake and making for Nyangwe. There he would decide as to his future route of exploration by proceeding to the M'Kinyaga country, where he expected to find the true head of the Kitangule Kagera, or he would follow the right bank of the Lualaba to "some known point."

Turning to the more northern portion of Nile Land, we find that Dr. P. Ascherson, who, two years previously, had been botanising with Rohlfs, had left Benisuef, Egypt, on the 16th of March, 1876, for Medinet-el Fayum, and reached Bauite, the capital of the Oasis Parva, on the 1st of April, returning by a new route to the Nile at Samalut, having completed the flora of the region, and discovered plants in the oasis which were of a more Eastern habit, and not known to have existed there.

Drs. Schweinfurth and Gussfeldt returned last May from a visit to the desert countries to the east of the Nile, near the monasteries of San Antonio and St. Paul. The former had botanised and studied the geology of the region, and the latter had determined the positions of twenty stations.

New Routes to Central Africa.—On the Zanzibar side of Africa great strides are being made to open up the interior to commerce; but we want the country more fully surveyed before stating what particular routes are the best. On this subject I would call your attention to the excellent paper by Mr. E. Hutchinson (of the Church Missionary Society), published in the 'Journal of the Society of Arts,' March 30th, 1877. No doubt there is ample room in so extensive a region, from north to south and from east to west, for half-a-dozen routes The line from Formosa Bay by the River Dana and Mount Kenia to Victoria Nyanza would recommend itself as the shortest to this great lake; but, till a survey has been made of it, we cannot say whether the country or the inhabitants are such as to render such a route practicable. Sooner or later, however, it must be one of the principal ones to the north end of Victoria Lake. Proceeding further south to Momhas, a route from here westwards in the direction of the southern end of Lake Victoria would have the advantage of being the shortest to this named point. Then follow routes to M'papwa, as adopted by Mr. Mackay and the Rev. Roger Price; the old main road to Unyanyembe. Also the Rovuma route upon which, at one hundred miles from the coast, the Rev. Dr. Steere has placed a colony of liberated slaves as an experiment. In connection with this, a recent visit paid by Dr. Kirk, in H.M.S. *Philomel*, to the coast district between Kilwa and Cape Delgado, has an important bearing. In a despatch, a copy of which has been sent to us by Lord Derby, this experienced observer says that a great change had taken place since 1873, in the trade and social condition of this region. The slave-trade, which formerly constituted almost the sole occupation of chiefs and merchants, had ceased, and in its place a healthy and active commerce in the natural products of the country had become established. We learn also from Dr. Kirk, that Capt. Elton, Consul at Mozambique, is about to visit the northern end of Lake Nyassa, viâ the Zambesi and the Shiré, and thence to return to the coast overland, thus supplying the desideratum—the exploration of the nearest route to the northern end of the lake, which is dwelt upon in Mr. James Stevenson's recent pamphlet, 'Notes on the Country between Kilwa and Tanganyika.' All these are advances towards civilization, and we hail with pleasure the worthy efforts that are being made to establish a regular route for communication between the port of Kilwa and the north end of Nyassa, as it will be an independent means of transport for goods to the shore of the Lake, and need not interfere with, but will encourage, the trade of the Portuguese at Quillimane and other possessions on the coast. It is also in contemplation to survey a road connecting a depôt at the north end of Nyassa with the south end of Tanganyika, where the London Missionary Society propose to form a station in connection with others at Ujiji, or some such suitable place. Further south still, an attempt will probably be made to survey a direct line of country, from south to north, from the Gold-fields of the Trans-Vaal to Unyanyembe. The Church Missionary Society are trying to construct a road to M'papwa, and we expect to hear shortly that their parties have been received by the Kings M'tesa of Uganda, and Rumanyika of Karagweh. One party has already reached Kagehyi, on the southern shores of Victoria Nyanza; on the other hand, a well-equipped party of the London Missionary Society left England on the 14th of April last, *en route* for Lake Tanganyika, viâ M'papwa. The good service rendered by the Rev. Roger Price —in having successfully travelled to M'papwa with four bullocks for the purpose of ascertaining whether the route was suitable for the employment of these animals—is most commendable: he found by actual experiment that it is perfectly feasible to take a bullock-wagon from the Eastern Sea-coast up to the Central Plateau, and that there is neither jungle nor swamp, hill nor tsetse-fly, to hinder such a course. This marks a new era in African travel; for if the impediment of porters can be got over by any means, whether by bullock-carts, or, which we have more faith in, camels as beasts of burden, we shall be independent of porters, and be able to employ the men in other ways.

We were rejoiced on the 26th of February last to have Mr. E. D. Young once more amongst us, and to hear from him an account of his latest journey to Africa. He has successfully established the Missionary party, sent out with splendid liberality by the Scottish Free Church Mission Committee, at "Livingstonia," on the southern shores of Nyassa; and has been the first to launch a steamer on the waters of an African lake. After an absence of twenty-one months, he has returned, in nowise impaired in health or energy by the work he performed. The chief interest in his journey to us Geographers is that the Lake is found to be 100 miles longer than Dr. Livingstone supposed it to be. We may also congratulate ourselves on the fact that Mr. Young has made a treaty between the Makololo and the Maviti, or Watuta of Speke. The latter are a wandering and plundering set of thieves and murderers, who range along the Nyassa Lake, extend to Tanganyika, and have even crossed the route between Unyanyembe and Usui. They are a very numerous class, of no particular race; and if this alliance made by Mr. Young holds good, and were extended to them all, trade and the industry of the regular inhabitants would have a better chance of succeeding.

German Expeditions.—Dr. Lenz returned to Hamburg from the Ogowé and Gaboon region, West Africa, on the 27th of January last, his farthest point having been a waterfall beyond Lonju on the River Muni, where his stores failed him. The Doctor's health had suffered severely from dropsy.

Dr. Poggé reached Hamburg on the same date, having made a most successful journey to Musumbe, the capital of the present Muata Yanvo, the suzerain of the Cazembe. His farthest point was Inshabaraka, and he would have gone to the town of the Cazembe but was prohibited. By travelling with a native caravan he obtained much information regarding the countries between the Kasai and Quango, and made considerable collections of insects and plants, besides getting sixteen skulls of numerous races of the interior. Musumbe, which had never before been visited by any explorer, lies many days' journey to the north, and west of Cameron's line of march. Dr. Pogge thinks that the River Kasai is the main feeder of the Congo, and that the Lualāba belongs to the Ogowé system, but this is disputed by other authorities.

Herr Edward Mohr, who came to England last year, and was present at our Anniversary Dinner, is said to have died of fever on the 26th of November, 1876, at Melanje. There was also a rumour of his having been poisoned, but we have no particulars as to his exact death. He had reached St. Paul de Loando on the 28th of August last, and left for Melanje upon the 1st of September. Turning to the East Coast of Africa, we learn that Dr. G. A. Fischer and Herr A. Denhardt (an engineer) were to proceed to Zanzibar last December, in the hope of ascending either the River Dana or Ozy, near Formosa Bay, and penetrating *viâ* Kenia to the Victoria Lake. This is one of the most important routes, as previously stated, in East Africa; and, if the people in the interior prove hospitable, great results may be expected from opening up this, perhaps the most fertile region in Africa, being within a degree or so of the Equator. They are to introduce a novel mode of communication—carrier-pigeons. Herr J. M. Hildebrandt also proceeds in this journey to the Lake.

Dr. Ervin von Bary reports in December last, to the German African Society, that he was on his way to Jebel Ahaggar, in the Tuareg country; but in consequence of disturbances there, he has altered his plan, and purposes reaching Timbuctoo by a more southerly route. The latest account of the Doctor is that he had reached the hot-spring of Sebarbaret, which is 150 miles north-west of Ghat.

French Expeditions.—The Expedition under Lieutenant de Brazza, of the French Navy, with Dr. Ballay and M. Marche, and seventy soldiers, intended to proceed from the west up the River Ogowé, and on till they reached the Albert Nyanza or the Niam-Niam country. Dr. Ballay arrived at a point 250 miles from Gaboon; but the party had suffered much in the loss of instruments by the upsetting of canoes. There was a greater annoyance still than this:

the tribe of Osyeba were not at all inclined to be friendly, having had a serious misunderstanding with a previous party of explorers; and it was doubtful whether the present party could proceed to the interior by this route. M. V. Largeau, who had made two journeys in the north-west of Africa, was appointed by the French Geographical Society to command an expedition from the Mediterranean to Assini on the Gold Coast last July. He would explore the Jebel Ahaggar in the Tuareg country, and visit Timbuctoo. The latest accounts were received in April, stating that M. Largeau would leave Biskra for Tuat, *viâ* the Wady Myah, on his way to the Ahaggar country, immediately on receiving his supplies. Surveys of the coasts of Southern Tunis and Tripoli, which are occupied by tribes who are said to plunder both by sea and land, have been completed by Captain Mouchez, of the French Navy; and Captain Rondaire has completed the levelling of the Tunisian Shotts, leaving no doubt that an inland lake might be formed to the south-west of Algeria.

Italian Expedition.—The Marquis Antinori and party having left Europe on the 8th of April, 1875, on an exploration of four years to the capital of Shoa, and thence to the Equatorial Lakes, had reached Lichi, in the kingdom of Shoa, all safe and well, after, however, having escaped assassination between Zeila and Harar, and experienced difficulties in crossing the Hawash. He anxiously looked for the arrival of Captain Martini with supplies before proceeding farther; and as this officer was to be conveyed to Zeila in the Italian corvette *Scilla* last March, we hope the Marquis will not be detained in proceeding upon his very important journey to Victoria Lake, but, meantime, he had met with a gun-shot accident.

Portuguese Expedition.—We have lately heard that the Government of Portugal have, with the most enlightened liberality, reminding us of their former glory in Geography, voted the sum of 20,000*l.* towards exploration in the interior from their possessions on both coasts; and we congratulate their Geographical Committee, and welcome them in the field of research and discovery. They have suffered a great loss in the death, on the 7th of December last, at Loanda, of Baron Barth, who was engaged on a Geological and Geographical Survey of Angola.

West Coast.—M. M. J. Bonnat, a resident for many years in Western Africa, particularly in the Ashanti country, took five boats and twenty-seven men up the Volta River on the 7th of December 1875, and reached, partly by water and by land, Salaha, or Paraha, the commercial capital of these parts; a town which was very populous at one time, but now contains only 18,000 people. M. Bonnat states that the Labelle Rapids, though 25 feet high, can be ascended by steamer during the rains in September and October, because the river rises 50 feet at this season.

We have already alluded to the interesting Paper of Captain J. S. Hay, who read it to us last June, on his residence for three months at Kyebi, the capital of Akém, West Coast of Africa. The district lies between 6° and 7° N. lat., and to the east of Ashanti. The Captain was there on duty guarding the Protectorate, during a war between the Ashantis and Djaubins, towards the end of 1875. In November, when he traversed the route from Accra inland, it was mud and water for days, and rain fell daily. On reaching the interior, the country is mountainous. The people live on the tops of their hills in houses completely concealed by the dense primæval forest; but there is abundant food obtainable, the soil being rich, and four rivers run through the country. These are only navigable for small boats, and are broken by waterfalls. Gold and timber seem to be the richest products of this region.

AFRICAN EXPLORATION FUND.—Having now passed in review the various African Explorations, British and Foreign, already completed or in progress during the past year, it only remains for me to bring more especially under the notice of this Meeting and the Society, the steps which have been taken since my opening Address to give effect to the desire of the Council to promote, to the extent of their power, the continuous and systematic exploration of Africa, and more especially of that large region extending from the Equator to the Cape of Good Hope. After the Meeting of the Conference at Brussels in September 1876, at the invitation of the King of the Belgians, and from that time, the subject has engaged the serious attention of the Council. Unable by the Charter of the Society, and the declared objects of its constitution, to enter upon any undertaking not strictly Geographical, it was found impossible for them to take part in the International Organisation inaugurated at the Brussels Conference for much larger objects. They were reluctantly, therefore, obliged to decline entering into the plans for affiliated and international labour in this field, and to form a separate Committee, under the title of an "African Exploration Fund Committee," acting under the direction of the Council, and independent of all International or other

Associations and Societies with similar objects. Independent so far as their responsibility and action are concerned, they will maintain a correspondence, and cordially co-operate as far as the constitution of the Royal Geographical Society will admit, with all other Societies or bodies engaged in advancing African Exploration, and more especially with the International Commission permanently sitting in Brussels.

The Council, animated with these sentiments, placed them, together with the objects they proposed to accomplish, on record in a Minute constituting the Committee above referred to, and defining their powers and the duties assigned to them. Having obtained the consent of His Royal Highness the Prince of Wales to associate his name as Patron, this Committee have since been maturing their plan of operations, and preparing a Sketch-map to accompany a Circular, appealing to the Society and to the public for support and co-operation in the prosecution of such continuous and systematic Explorations in Africa as they are satisfied will best advance the Geographical knowledge of these regions, and, in the proportion that it is attained, will also materially tend to promote both commerce and civilisation.

This Circular, and the proposed proceedings of the Committee, have now received the sanction of the Council, and it will be very shortly circulated among the Fellows, together with the original Minute; and, in that shape, it is thought the whole subject may be brought before the public in a satisfactory manner, with a view to obtain the necessary funds. Great interests, besides those of Geographical science, are concerned, if not inseparably connected with a successful prosecution of the work now contemplated, and the subject is one of the most important, both in a national and philanthropic sense, that can well engage the sympathies and attention of this Society and the community at large. Under these circumstances the Council feel confident that the appeal they have now willingly sanctioned will meet with a ready response over a wide area, not limited to the United Kingdom, but including all our Colonies, one of which, by no means the least important, is more deeply interested in the prosecution of these Geographical Explorations than any other portion of the British Empire.

POSTSCRIPT.

Chinese Empire.—After the foregoing was made ready for the press, I received from our Honorary Corresponding Member, Baron von Richthofen, the well-known geologist and traveller in China, a copy of the first volume of his magnificent work, entitled 'China, Ergebnisse eigener Reisen und darauf gegründeter Studien. Berlin, 1877.' The Presidential Address for this year would be very incomplete without a brief notice of this volume, forming, as it does, the commencement of what will undoubtedly be one of the most complete works on a subject of Special Geography which has appeared in our time. The volume, although only the introductory part of the work, forms a handsome quarto of 760 pages, well illustrated by maps and diagrams, and treats principally of the General Geography of Central Asia and China Proper, entering thoroughly into the formation of the surface and the causes of the striking diversity between the central and outer regions, the nature of the "loess" which covers nearly all Northern China, and is the cause of its fertility, and other features of Physical Geography. The more detailed account of the author's investigations of the coal-fields and general Geology is reserved for the subsequent volumes, three in number. The completed work will be accompanied by an Atlas of 44 maps, constructed by the author, who made this one of his chief tasks during his long journey through the Chinese Provinces.